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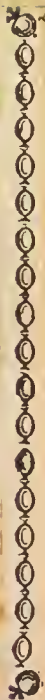
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A

PRACTICAL INQUIRY

ON

DISORDERED RESPIRATION;

DISTINGUISHING

CONVULSIVE ASTHMA,

ITS SPECIFIC CAUSES, AND PROPER INDICATIONS OF
CURE.

By ROBERT BREE, M. D.

LATE OF UNIVERSITY COLLEGE, OXFORD, AND THE UNIVERSITY OF
EDINBURGH, &c. &c.



“ Quis diu expirat? Omnia corporis aut incommoda aut pericula per me
transierunt: nullum mihi videtur molestius. Quid ni? Aliud enim,
quicquid est, ægrotare est: hoc, est animam agere. Itaque, medici
hanc meditationem mortis vocant.”

Seneca de Suspirio, Epist. LIV.

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P R E F A C E.

IN the following pages, we enter upon a subject as curious as any which nosology can furnish. “Nothing,” says Willis, “can be more terrible than a paroxysm of Asthma. The organs of respiration, which are the pillars of life, are shaken to their foundation, and the entire destruction of the animal machine is apparently threatened.”

Writers have generally spoken of Asthma without precision, and the confusion which has prevailed, may partly vindicate a more systematic arrangement of its causes. I may assume hopes of being useful from the opinion of Dr. Hebbarden, which I apply to my personal acquaintance with the disease, in many years of hard submission to its impressions.

*According to his authority, “ There cannot
“ be a more favourable opportunity of learning
“ the nature and cure of a distemper, than
“ when we meet with a case where the physician
“ has been always present with the patient, and
“ where he must be supposed to have paid due
“ attention to every circumstance.”*

MED. TRANSACT.

A new Inquiry may embrace the aids of an enlarged knowledge of the function of respiration, of the recent discoveries in pneumatic medicine, and of the elucidation of laws which govern the motions of animated matter.

As to theory, I value it only as it exhibits indications of cure, which have not been sufficiently, if at all, recognized in former pathologies of Asthma. I have traced effects to particular, and to general causes, and I meet with analogy giving its support to their connection. I may, therefore, form a sanguine opinion of the

truth of the principles which I have applied, but my confidence is still limited to the extent of their practical uses.

Whatever doctrine I have advanced, cannot be controverted without a supply of new science, and humanity gaining by the display of error. The old opinions were confessedly no guides to a successful practice; of these, I say experimentally, that they direct to a more certain prognostic, and to an improved method of cure.

BIRMINGHAM,
JULY, 1797.

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326	—	13	—	diaphragms	—	diaphragm.
354	—	22	—	orthodox	—	orthodoxy.
368	—	9	—	uses	—	use.

PRACTICAL INQUIRY, &c.

PART I.

SECT. I.

The Pulmonary System.—Its Diseases.—Two States particularly affirmed, inducing Phthisis and Asthma.

THE lungs exactly fill the sacs of the pleura in that cavity of the body called the thorax.

They are divided into right and left, and resemble the figure of the sacs, internally making a concavity which receives the heart.

The right is larger than the left, and is again subdivided into three lobes.

Betwixt the lungs and pleura, as in the pericardium, there is a ferous vapour which is coagulable.

The external membrane of the lungs is continued from the pleura, and is spread all over them.

The internal structure of the lungs is made up of lobes separated by intermediate intervals, in which is a loose cellular substance. These lobes are divided and subdivided through a long series, till at last they terminate in very small membranous cells, variously figured, called vesicles.

These air cells or vesicles freely admit the air from the branches of the trachea, or wind-pipe, and they are filled with air through this wind-pipe, and that only.

The wind-pipe begins at the larynx, and is made up of cartilaginous and muscular rings, which are thin and elastic; flatter and thicker before, but thinner behind, where their extremities are united by strong muscular fibres, which complete the circle: but the lowermost rings within the lungs are less, and not so perfect.

Fleshy fibres make alternately other rings: some of these are transverse, others longitudinal, intended to lessen the wind-pipe in its transverse diameter, or its length: by this construction of the rings, they are in some degree obedient to the will, like the external respiratory muscles, and in expiration the second ring of the bronchia enters within the first, the third within the second, and the following always enters the preceding.

There is a cellular coat which furrounds the muscular one, where are seated numberless simple glands, whose minute excretory ducts open like pores into the wind-pipe, and deposit a limpid mucus in the cavity, which is not coagulable. Its use is to defend the sensible membrane from acrid particles floating in the air.

Internally the wind-pipe is lined with a delicate membrane smooth and irritable, continued from the mouth, and this likewise, as well as the muscular coat, is furrounded with cellular texture.

About the third vertebra the wind-pipe is divided into two branches, which resemble the trunk itself: each branch enters the lung with which it corresponds. Here the cartilaginous rings begin to change, and become more irregular circles, gradually taking into their construction more and more membrane, and at last the terminations of the bronchia are merely membranous.

These ultimate portions of the bronchia pass the air into the vesicles, and receive the vapour exhaled from the arteries into these spaces, and pass it off in expiration.

An artery and vein accompany the bronchia, sometimes even three arteries, and two

veins, through their ramifications, and occasionally are known to inosculate with the pulmonary artery and vein.

But the pulmonary artery and vein are the principal vessels of the lungs, and the branches of these, with the branches of the bronchia, surrounded with cellular texture, pervade every part.

Upon the air vesicles the blood vessels are spread and interwoven like the meshes of a net. Here the capillary arteries exhale a copious vapour into the cells, and injections being forced into the pulmonary artery, flow into the wind-pipe, and, *é contra*, being forced from the wind-pipe, they pass into the artery.

The lymphatics are very numerous in the lungs, and form a perfect network on their surface.

The pulmonary nerves are small: they come from the eighth pair, from the recurrent, and from the cardiac. The nerves being so small, the lungs have little sensation.

The quantity of blood passing through the lungs, is at least equal to that of the whole quantity which passes through the rest of the body in the same space of time.

The use of the lungs is respiration, and to perform this function, the capacity of the cavity of the lungs must be encreased, that the

external air may rush through the trachea, and restore an equilibrium which by this dilatation of the organ had been lost by rarefaction of that fluid. Thus when the air which is always in the lungs, becomes expanded by the dilating of the thorax, its spring is weakened, and it makes less resistance to the external air; which then enters, and the density of internal and external air is rendered equal.

To perform this operation of encreasing the pulmonary cavities, the thorax is elevated by the contraction of the intercostal muscles: by the action of the diaphragm, which presses down the abdomen, and relatively to the thorax, is then plane instead of convex. By this contraction of the diaphragm, respiration may be almost performed alone, and its force in dilating the breast is greater than that of all the other powers.

Without these united powers, the lungs have no inherent power by which they can attract air: but when any difficulty occurs to the exercise of the function, encreased powers are called into action, to remove it, as the muscles inserted into the thorax, scapulæ and clavicles: the ^asceleni, trapezii, cervicales descendentes, serrati superiores and pectorales, with the small elevators.

In expiration, the elastic force of the bronchia and vesicles is made use of. They strive to contract themselves to expel the air, and thus assist the external force which is exerted by the muscles of the abdomen.

But in extraordinary cases, other muscular powers are called upon to assist in expiration, as the sacro-lumbalis, longissimus and quadratus of the back and loins.

By this plan it appears, that as soon as uneasiness is felt from the hindrance of the progress of the blood through the lungs, the expiratory powers are relaxed, and those of inspiration are excited, that the course of the blood may be free and quick through the lungs, which, in their collapsed state of expiration, was obstructed in its passage.

An important purpose of respiration is also to impart heat; and to give to the blood a quality, which in its course through the body is continually being discharged.

The acquisition is oxygen; a component part of atmospheric air, which, being decomposed in the lungs by a chemical process, furnishes it to the blood by attraction through the fine and soft texture of the membrane of the air vesicles.

THIS system is liable to suffer two principal diseases, which proceed from an alteration of the vascular structure of the vesiculæ and bronchia. These diseases are the same in one vesicle as another, but every vesicle is not equally affected by them at the same time. It is sufficient to shew the state of one vesicle in each disease, and it will be readily comprehended how the lungs, which are a congeries of vesicles, may be wholly, or in part influenced by these disorders.

The capillary blood vessels are so spread on the membrane which makes the divisions of the vesicles, and the vesicles themselves, that they appear like a thick network of veins and arteries. The arterial capillaries are constituted as to density and tenacity of their coats, in proportion to the arterial branches nearer to the heart, and of course are susceptible of the constitution, which is described under the character of Sanguine Temperament. If from the causes which induce Phthisis, these capillaries are inflamed, the membrane of a vesicle will soon become dry; serum will be exhaled into the cell in quantity insufficient to lubricate the lining, and the absorbent lymphatics will drink up the little moisture effused as fast as it is

bestowed. A dry cough then comes on, which is not excited to relieve the vesicles of mucus, and no mucus is discharged, but it is the effect of irritation on the inflamed lining. In this state the action of the vessels is attempted to be diminished by blood letting, and lubricating and saline demulcents.—It too often happens that the vascular action is reduced, but the local disorder remains, because these minute capillaries have been from some occasional predisponent causes, peculiarly adapted to assume inflammatory adhesion of their sides and orifices. Here then is a situation in which phthisis may be suspended by evacuation of the vessels, which will diminish the impulse of the blood against their extremities, but cannot be prevented from establishing itself unless the adhesion can be removed, and a healthy exhalation of lymph be restored. The slightest causes of fever, by accelerating the circulation, will become the exciting causes of phthisis; the impetus of the blood will then only create new inflammation and adhesion in the parts of the arterial vessels successively more remote from their orifices. And the usual condition of an inflamed part when it neither dies by gangrene, nor is restored to healthy function, supervenes upon the capillary as far as it is impacted from the exhalent mouth.

But if considerable evacuations have not been pursued to lower the vigour of vascular action, the inflammatory adhesion will be more rapidly established, and proceed to a purulent crisis with greater speed, hæmorrhages of red blood preceding suppuration, or attending it. In the beginning, therefore, the vesicle becomes the seat of a dry and inflamed membrane, next of purulent corruption of the substance of the capillary arteries which open into it, with red blood effused from the ruptured arteries in that part of their course where the adhesion of their sides ceases.

This disease is called Phthisis, depending on a state of the capillary exhalents, the reverse of laxity, which induces the other disease to which a vesicle of the lungs may be subject.

In habits of an opposite temperament, a vesicle of the lungs does not become dry; the numerous capillary orifices are not so susceptible of inflammation, and fever very rarely attacks the system. If pyrexia takes place, it may be traced to an accidental cause, and it does not readily induce hæmorrhage from the minute vessels, nor inflammatory adhesion of their sides. This difference is to be accounted for by the constitutional structure of their coats; which are less thin, and more dilatable, and from many causes which affect the general

system, and which are to be explained hereafter. The capillary vessels are therefore not affected in this disease with circumstances either local or general which destroy their exhalent structure, but they submit to a progressive loss of tone, and become unable to contract their diameter, from the stimulus of distending fluid. The fluid itself is deficient in properties which excite the vascular system to contract in a state of health, and external causes concurring, serum is effused into the vesicle in greater quantity than the absorbents can regularly drink up, or respiration in its usual exercise discharge. When the fluid has accumulated in this manner, it becomes, from irritation, the cause of convulsive Asthma.

These two are the most important diseases to which the Pulmonary System is liable to submit. They both arise out of the state of the capillary extremities of the arteries which open into the vesiculæ and bronchia, but chiefly the former.

There are also in some habits, ruptures of the small veins of the lungs, creating a disease which is seldom very difficult to be controuled if it is properly distinguished; and there are states of the lungs which are modifications of the two conditions of the vesicle above *affirmed*, sometimes partaking of the nature of each, the

capillaries of one vesicle, or one lobe, not having lost their contractile tone, but being liable to be impacted by accidental causes; whilst the capillaries of another vesicle, or another lobe, are in too relaxed a state, and suffer the effusion of too much serum. The constitution is then librating between Phthisis and Asthma, and gives an opportunity for various practice arising from contra-indications.

Phthisis and Asthma comprehend the features of every serious indisposition which can generally attack the lungs, and they illustrate mutually the character of each. It will be found, that in their regular, simple, and uncomplicated forms, the remedies of one are the exciting causes of the other, and the causes of the one are reciprocally the remedies of the other. Phthisis is more fatal in its issue than Asthma, because its tendency points to the destruction of the organ it attacks; and after a certain stage in its progress, medical treatment is opposed to its ravages without hope, and surely without success. In Asthma the omens are more propitious, and the object to be attained is worthy of every effort which judgment and reflection can direct.

This is the general prospect of the ground of the succeeding observations, as they refer to that species of Asthma commonly called spaf-

modic or convulsive; *affirmed*, but not hypothetically, for it is believed that the experience of physicians has justified the outline; evidence from the animal œconomy, practical observation, and induction from facts, will be adduced in its further support.

It will be convenient to precede the explanation of this form of Asthma, by considerations on the species where the cause is more conspicuous, and thus to illustrate the progress of further enquiry; but first it may be necessary to define the generic term of Asthma, which sometimes has been used in a very loose sense, at others limited with unnecessary strictness of application.

SECT. II.

Asthma a general name for disordered respiration.—The proximate cause.—Violent muscular action indicates irritation; as in the stomach, gall duct, bowels.—Irritation in the pulmonary organ.—Difficultas spirandi, this term does not explain the natural fact; always to be referred to irritation.—A more precise idea of the instruments of excessive respiration.—Analogy of the perception of irritation in the lungs, and in the rectum and bladder.—Motus Medicati of Gaubius.

ASTHMA, in its original or its degenerated meaning, long continued to embrace all the cases of difficult respiration. If nosologists have attempted to confine the term to a peculiar form of this general affection, it is not consistent with the comprehensive view which will be taken of the disorder here, to follow their example.

I shall recur to the definition of Willis, not finding in the interval of years, which

have elapsed since his writings appeared, that the pathology of Asthma has been in the least improved. The practice has certainly not been more successful, though divested of much encumbrance. “Asthma,” says this author, “dicitur ab ἀσθμαίνειν, (quod est anhelare, sive “difficulter respirare) et describi potest, quod “fit *respiratio difficilis, crebra, et anhelosa, cum “magna pectoris agitatione, et plerumque citra “febrem.*”*

Frederic Hoffinan gives the same latitude to the term in the following description:

“Hoc vero (Asthma) secundum nostram “sententiam nihil est, quam *impedita, et laboriosa admodum respiratio, cum ineffabili anxietate, et præcordiorum angustia juncta, liberum sanguinis per pulmones circuitum turbans, a variis causis suborta, periculi suffocationis non expers.*”†

These authors adopted the Greek word as the head of a class of specific varieties, and afterwards entered into distinctions of the several causes which, according to their observation, were productive of that uniform apparent effect “difficult respiration.”

* Thomæ Willis Opera Omnia. Genevæ, 1680. Tomus Posterior, Caput. xii. de Asthmate.

† Friderici Hoffmanni Medicin. Rationalis Systemat. Tom. 3. Sect. II. Cap. II. § II.

I shall imitate their method, and define Asthma in so general and simple a manner, that it may comprehend as many species of disordered respiration as nosology may present, or medical experience incline to class under the name.

Asthma is an excessive contraction of the muscles of respiration, usually called difficulty of breathing, excited by irritation, and proceeding from various remote causes.

Under this generic definition are comprehended all affections which disorder respiration, by exciting an unusual action of the muscles exercised in that function. The influence on these muscles being the same in kind, though distinct in quantity of force, from the irritation of a simple catarrh, to the ponderous offence of a vomica in the substance of the lungs. In the convulsive spasmodic species the muscles are contracted with more energy and violence than in any other, but the contractions in this case do not obey any law, nor assume any form which is not common to the extraordinary action of the same muscles in milder instances of dyspnæa.

The difficulty of assigning to a disease its true origin, will be considerably encreased by neglecting a strict observation of the characteristic symptoms which distinguish it, but

Asthma has met with the fate of being subjected to the caprice of hypothesis and prevailing theories, more than any others whose appearances could be distinctly traced to a material exciting cause.

The particular irritation, which in disorders of the alimentary canal had excited the convulsive contractions of the stomach or bowels, has been marked by physicians with ready and concurrent testimony of the impatience with which the animal œconomy suffers the slightest interruption of its functions. It is, indeed, agreeable to reason and philosophy to infer, that in any violent exercise of a particular organ, the energy which is exerted in excess, is directed by nature to some salutary end. If a material stimulates, the coats of the stomach, by its acrid quality, or distending quantity, and impedes the regular digestion of food, that material must be ejected for the safety of the body, and vomiting is excited. If a gall stone impacts the duct, and prevents the discharge of bile into the bowels, the animal motions are encreased, and the excess of muscular action is pointed to the removal of the irritating and obstructing cause. If scybala are included in the cells of the colon, there is no tranquil and continuous peristaltic motion after the hard masses of feces are perceived to

irritate the coats of the bowels, more violent, and even convulsive muscular contractions supervene, and continue till the offending matter is discharged.

Irritation on the pulmonary organ is productive equally of violent effects, and draws into association the action of all the muscles of respiration.

Such association of muscular motions has lately been delineated with accuracy by Dr. Darwin, as a natural consequence of the irritation of the fibre, and the appearance of their convulsive efforts by a law of the natural œconomy may be justly accepted as evidence of some injury to be repelled, or some offensive matter to be discharged.*

Alexander Monro, senior, has not taken so diffuse a range through the analogies of natural phenomena in animal life as the author of *Zoonomia*, but he perceived, and has stated the effects of sensitive association of muscles for the relief of unnecessary irritation as follows:

“ Whenever the uneasy sensation, pain,
“ is raised by the too strong application of
“ objects, a sort of necessity is as it were im-
“ posed upon the mind, to endeavour to get

* Vide *Zoonomia*, Vol. I. Sect. VIII. 3. and X. 2.

“ free of the injuring cause, by either with-
 “ drawing the grieved part of the body from
 “ it, as one retires his hand when his finger
 “ is pricked or burnt; or the injuring cause
 “ is endeavoured to be forced from the body,
 “ as a tenesmus excites the contraction which
 “ pushes acrid feces out of the rectum. In
 “ both these operations, a convulsive contrac-
 “ tion is immediately made in the lesed part,
 “ or in the neighbourhood of it; and if the
 “ irritation is very strong or permanent, the
 “ greater part of the nervous system becomes
 “ affected in that spasmodic or convulsive
 “ way.”*

But if some physicians have applied these laws in instances where irritation has been observed and known to excite the phænomena of convulsive muscular contractions, a particular consideration of the causes which may offend the system in the pulmonary organ, has been generally neglected. Though its action is critically important to the preservation of life, and to the nice equilibrium of its dependencies. Hence the respiratory muscles have been excited to the most laborious efforts, but in general cases, comprized in one species of Asthma, their action has not been assigned to

* Alex. Monro, senior, on the nerves 66. k.

the influence of an irritating cause, or the operation of an unusual material disturbing the function of the organ.

In another species of Asthma, by the existence of a vomica, or some oppressive inconvenience, the cause has been so undeniable as to preclude dispute, but even here it has been the custom to consider the extraneous matter with too slight a distinction of the principle by which it offends, and rather to refer the dyspnoea to a mechanical obstruction, than by comprehensive reasoning to attempt the discovery of a common cause by which the effect may be explained, in consistency with the simplicity of natural laws.

In the endeavour to class phenomena of uniform general appearance under one head, it will be necessary to examine them with greater precision than they may possibly seem to require. But preoccupation of terms is an insufficient proof of the character of a disease, though it may have inspired popular confidence in the propriety of an established name.

Asthma is said to be distinguished by difficulty of breathing. “*Spirandi difficultas*,”* but it is necessary to understand in what sense the term is to be taken.

* Cullen. Nosolog.

It is certain, that when no unnatural irritation exists in the organ, its functions are carried on in the calmest manner, and there is neither excitement to full inspiration, nor necessity of renewing, by one effort, the whole measure of air which filled the cavities. Respiration has frequently been so imperceptible in some conditions of the body, that observers have been uncertain whether life was not extinct.

The quantity of air inspired is also different in different men, and in the same man at different times: hence philosophers have varied in their accounts of the measure of air in each inspiration.

Borelli* makes the quantity from 15 to 20 cubic inches in one ordinary inspiration, whilst Dr. Goodwin says, the greatest quantity received in the same effort, is 12 cubic inches, expanded in the lungs to 14.

The quantity usually expired is equal to 40 cubic inches, as stated by Messrs. Jurin, Hales, Haller, Sauvage, Menzies, &c.

Dr. Goodwin† informs us, that the air remaining in the lungs after complete expiration, is 109 cubic inches, and that the propor-

* On the Motion of Animals, p. 119, 133.

† Connection of Life with Respiration, p. 27.

tion of the dilatation of the lungs before and after a healthy inspiration, is as 109 to 123.*

But according to Dr. Menzies,† the dilatation of the organ in the same circumstances, is in the proportion of 179 to 219.

There is, therefore, in health, no determinate measure of the air consumed in respiration within certain limits; and in disease, if the pulmonary organ is not excited by a stimulus extraneous to its ordinary functions, the respiratory muscles are not called into any unusual action, though the difference between the effort of “an *ordinary* and a *full* inspiration, is as 14 to 200 cubic inches.‡”

The difficulty will then be said to consist in obtaining, at each inspiration, a measure of air equal to 12 cubic inches, a sum which is sufficient for the system in ordinary health. There is no proof yet, with how small a portion of atmospheric air life may be sustained, whilst its purity remains at the usual standard. In sleep the inspirations are very infrequent, and sometimes without any perceptible contraction of the respiratory muscles, or elevation of the breast. But animals pass whole winters in sleep§, and emerge from it in spring

* Goodwin, p. 37. † Menzies on respiration by Sugrue, p. 32.

‡ Vide Dr. Goodwin, p. 32. note. § Haller Element. Physiolog. I. 39.

with increafe of fat, which, by Dr. Beddoes,* is attributed to the deficient infpiration of oxygen. It is certainly an evidence that the animal œconomy will admit of great latitude, and preſerve its functions in exerciſe with a quantity of air inſpired much ſmaller than it is poſſible to aſcertain, or to fix by any limit.

It is indiſpenſably neceſſary to allow this latitude as a law in the œconomy of life, or to revert to the doctrines of the old phyſicians, as the only adequate explanation of the extraordinary inſtances of apparent death and ſubſequent recovery.

Divers in the pearl fiſheries are ſaid to remain under water half an hour or longer. Diemerbroeck† relates an inſtance of a diver remaining in the ſea that length of time under his obſervation.

A ruſtic appeared to die of the plague, and after three days diſcovered no ſign of reſpiration or life, but on being carried to the grave recovered, and lived many years afterwards.‡

Iſtances of apparent death from drowning are numerous, and conſequent recoveries ſince the eſtabliſhment of the Humane Society

* Beddoes Obſervat. &c. on Obefity, p. 107. † Anatomes, Lib. II. p. 464.

‡ Diemerbroeck Traſtat. de peſte. Lib. 4. hiſt. 85.

are authenticated beyond suspicion or doubt, to the honour of the patrons and members of that invaluable institution.

Many curious histories are extant of persons roused from the tomb of death by accident or design, and may be seen in Diemerbroeck, Lib. II.—Joannes Mathæus Quæst. Med.—Philip. Salmuth. Cent. 2. Obs. 86, 87, 95.—Hildanus Cent. 2. Obs. 95, 96, and other writers possibly indulging too much in romance.*

If such circumstances of small respiration, or even, as it is alledged, of no respiration at all, have happened, who shall define the quantity of air essential to life?

It was the opinion of Galen,† that the heat of the heart was the cause of the necessity of respiration; because the blood being propelled from its fountain in a condition too hot and rarefied for the uses of the body, the refrigerating properties of atmospheric air were required to condense and cool it as it passed the lungs. This theory, however supported by authors of no inconsiderable weight since the time of Galen, has now yielded on the best grounds of

* Add to these facts, the curious relations of the discovery of living toads in the stems of elm and oak trees, by the Academy of Sciences of Paris, 1719, 1731.

† De Utilitate Respir. Cap. 3 and 4.

experiment, to an opposite doctrine. The blood is proved to acquire its heat from respiration alone; and the heart, instead of being cooled by the refrigeration of external air inspired by the lungs, derives its excitement from that source, and is enabled to transmit heat to all parts of the body.

But if we have arrived at the truth, and corrected the errors of the antient physicians, the difficulty is considerably increased by the improvement, as far as the consideration of the above curious facts extends. The fresh air is said to be necessary whilst the rarefied blood demands its refrigerating power from the heat of the heart being unimpaired; but if the heart is cooled, or its heat so diminished that the blood flows through the lungs without the usual tenuity, respiration is in proportion unnecessary. This reasoning, applied to the extraordinary cases of animation suspended, however false in principle, will explain the subject better than the modern truth. For taking simply the principle to which we assent upon conviction of experiment, that one final cause of respiration is to communicate heat to the blood, and excite the heart, by the presence of oxygen, these qualities being denied, immediate death should follow. It is scarcely sufficient to say that death certainly does follow, when

evidence has been given of the spark remaining alive from half an hour to many days interval, during the term of which they were not imparted to the system. A Galenist would triumph at the pre-eminence of his reasons for the preservation of the flame. He would say, that by the circumstances of the alledged cases the heat was so diminished in the different subjects as to take away the necessity of refrigeration by the lungs, that is of respiration; and that, until warmth was totally extinct life would remain without it. Such an explanation would apply to the cases of all the hybernating animals, of persons strangled by submersion, divers, and those whose excitability had been exhausted by the plague, nervous fevers, &c. But it would oppose the principle of Galen in another place, where he says, “It is impossible for a living animal not to respire, and for a respiring animal not to live.”*

I would apply these observations in support of the opinion here advanced, that the œconomy of animal life admits of such latitude in the application of exciting powers, and of such gradation in its loss of vigour from their absence, that it is almost a question if respiration could be measured too low to be inconsistent with its preservation.

* De Loc. Affect. Cap. 5.

Haller attributes to the act of expiration, such a condition of the lungs as even obstructs the circulation of the blood through them.

“ In expiratione vero pulmo undique ur-
 “ getur, et in multo minorem, molem compri-
 “ mitur: vasa ergo sanguinea breviora quidem
 “ fiunt cum retractis bronchiis, eademque an-
 “ gustiora nunc sunt, siquidem pectus secun-
 “ dum tres suas dimensiones arctatur.”*

In this state of collapse recurring at every expiration we should, at all events, find a distress for breath alternating with the inspirations, if the freedom or difficulty of breathing was to depend very critically on the portion of air measured out of the atmosphere, and received in the cavities of the lungs. This nicety is not acknowledged by the œconomy of the pulmonary system in its simple and healthful arrangements, but as soon as the organ feels the inconvenience of unnatural compression, the derangement assumes the character and force of irritation, exciting the muscles into energy of action. If the compression is external to the air cavities of the lungs, the respiratory labour will not be so great as if the cavities themselves are obstructed, and the peculiar diagnostics of periodic convulsive

* Haller, Lib. VIII. Sect. 4.

Asthma may not all be present, but dyspnœa, comprizing a set of symptoms of the same indication, but inferior force, seldom carried into paroxysms, but whose sum of uneasiness is perhaps not less, supplies its place.

Whenever, then, a compression of the lungs, or organic derangement irritates the organ, the effort which has been commonly called *difficulty of breathing* is excited, and fuller inspirations become a natural means of relief. In the instance of hydrothorax, the compression arising from an extraneous material, there is considerable dyspnœa; but in the expiration of Haller the compression being a natural operation of the system is not attended with uneasiness, and scarcely with conscious perception.

It is true there may be some difference in the degrees of compression from the two causes, and I am aware that Dr. Goodwin considers the compression of hydrothorax as influencing, in some instances, the pulmonary organ much more than the act of expiration can do. But here the object is not to enter into the discussion of the final cause of natural respiration, which that ingenious writer contends is not the dilatation of the lungs, but to establish the distinction of free or laborious respiration arising out of the simple condition of that

healthy organ, and its state embarrassed by any extraneous offence. I therefore satisfy myself with his concession, that though in the state of expiration there is not so great a change in the pulmonary vessels, as is asserted by Haller, “it may be still suspected that the
 “pulmonary blood does not circulate with
 “proper freedom in all the different states of
 “respiration; that in the state of expiration
 “the current may be so much retarded, as to
 “occasion an accumulation in the vessels of
 “the right side of the heart, sufficient to bring
 “on an interruption or suspension of some of
 “the other functions*.” But it is impossible to assent to the conclusion, that the same phenomena are to be expected in a state of natural compression from expiration, and in the extraneous compression of artificial hydrothorax. Dr. Goodwin kept in view the condition of the blood vessels and heart only in his experiments, but a relative condition cannot escape remark, as it must influence the capacity of the air vessels, and externally the sensibility and sympathy of the respiratory muscles.

In producing artificial hydrothorax in dogs,
 “in all of them it brought on a considerable
 “difficulty of breathing, but no other apparent inconvenience,”

* Dr. Goodwin, Sect. 3.

Respiration is an act which is increased in almost all cases of distress of mind or body. The first effort after recovery from syncope is that of a very deep inspiration by which the blood accumulated in the pulmonary vessels and the heart, and giving uneasiness to the lungs, is propelled through the vessels.

The motions of respiration are excited by the passions, and very frequently express their character. They are excited by irritation, and “by propensities to remove pain; this last cause of their excitement operates more frequently upon them than on any other function.”*

It is therefore concluded, that “difficulty of breathing,” in nosological, or in popular language, infers irritation in the pulmonary organ, and that it consists in the extraordinary contractions of the respiratory muscles; there being no data in existence to prove that the functions of the animal system will be stopped by the atmospheric air drawn into the lungs being diminished to any specific measure, however small, in ordinary respirations.

But when irritation is to be removed from the organ, there is in the process of deep inspiration a natural instrument employed, be-

* Cullen Instit. Med. CXCV.

cause whatever material is ejected in vapour, or in mucus from the trachea, the expiration which conveys it must be preceded by inspiration as deep as the seat of the offending matter. Without this effect of disengaging the lungs from offence, the convulsive breathing is excited without an object and without use.

But there has not only existed this mistake as to the final cause of extraordinary respiration; but some confusion of ideas has prevailed as to the phænomena which are to be observed in Asthma. The instruments which nature can alone call into action when the lungs are injured or oppressed, are the muscles which act externally in expanding or compressing their cavities, for the purpose of inspiring or expiring air.

The convulsions are therefore external to the lungs as far as any sensible phænomena point out irregular contractions of muscles. It is not, however, inconsistent with the nature of the operations of the brain, that a mistake should have occurred as to the proper instruments excited by its influence.

Almost all the motions called *spontaneous*, are performed without our consciousness; in some, not only the muscles themselves, but the effects of them are unknown, and the will

cannot therefore be supposed to interpose in directing the mode of action.*

The muscles of respiration are susceptible of spontaneous, as well as voluntary action, and the constant repetition of moderate respiratory motions introduces the more violent actions, frequently without a perceptible interval between the excess and common standard of their contractions. When the excess becomes considerable it brings on associated contractions of other muscles, and the peculiar nature of the irritation, which all these contractions are to discharge from the internal cavities of the breast is felt with such sensation of uneasiness as to turn the patient's attention entirely to that quarter. There may be the additional cause of such sensation in constrictions of the bronchia corresponding with the external contractions, but of this state there has yet been no proof.

The subject is illustrated still more by adverting to an irritation in the intestinum rectum. All the attention of the patient is then turned to the excruciating tenesmus, but it is indisputable that the violent peristaltic action above the rectum, and the strong contractions of the abdominal muscles and the

* *Monro on the Nervous System, Chap. XXVIII.*

diaphragm, are the instruments to evacuate the offence, and also most materially occasion or increase the pain in the portion where it rests.

In the discharge of urine the chief perceptions is in the bladder, but if the muscles which we have mentioned to act in expelling alvine feces, did not contract with great effort, the perception could not be so strong, as the propelling the contents towards the neck of the bladder must precede the relaxation of the sphincter. But the attention of the animal rests upon the effect, and the particular seat of the cause of these efforts, although no motion is at present performed by the bladder. Afterwards by the uniform and steady contraction of its own muscular coat the urine is expelled.*

Exactly this degree of perception of stimulus incites the actions of the respiratory muscles when the lungs are to be relieved. And the mind appears to admit of the same degree of consciousness of the effect to be produced whenever the irritation may be said to create *anxiety, distress for breath, and stricture about the sternum*. We have then consciousness sufficient to satisfy the scruples of a Stahlian, if he were disposed to deny the operation of the

* Monro on the Nervous System, Chap. XXVIII.

cause here assigned to Asthma, but without the rational necessity of acceding to the importance of any mental deliberations on the evil endured.

The contractions are really *Motus Medicati*, as Gaubius frequently terms them in beautiful and just description.

“ Multifariæ autem, quibus corpus vivum
 “ pollet, vires motrices, quum rebus nocivis
 “ irritatæ semet exserunt, præcipuum præ-
 “ stant vitæ ac sanitati præsidium. — Inde
 “ profluunt motus automatici, irregulares qui-
 “ dem multimodis, at sæpe beneficentissimi,
 “ certaue determinatione ad salutarem finem
 “ tendentes; etiam si mente nec imperante,
 “ nec conscia, et vel invita quoque, fiant,
 “ hujusque adeo consilio nequaquam tribui
 “ possint. His si careret homo, nulla vel
 “ sanitati constantia, vel morbo medela foret.”*

For the further advance of this object of restoring health or averting evil, sympathies are established in the œconomy, which by their correspondence rapidly excite a unity of design and effort in muscles, primarily calculated for separate duties. “ Accedit partium
 “ facultatumque consensus ac conspiratio qua
 “ mutuam sibi operantur, aliæ aliaram vice

* Gaubii Instit. Patholog. Medicin. 640.

“ funguntur, sanæque pro afflictis in motus
“ medicatos ruunt; ut horum junctis viribus
“ tanto minus resistere imminens præsensve
“ morbus possit.”*

It is very convincing that the muscles of respiration may be habituated to the operations of this sympathy, and excited to contract, by various and apparently dissimilar species of stimulus. The diaphragm and abdominal muscles are the natural and common instruments of official support to three functions; that of respiration, of alvine evacuation, and of urinary discharge. They are also the common instruments of relief to these three functions when disturbed by too much irritation. They act strongly upon the bladder, upon the bowels, and upon the lungs. Such a communication of assistance creates some alliance between them and other muscles which are not common to the exercise of the three functions, but which are more peculiarly appropriated to the separate duty of serving one,

A repetition of contractions produces the habit and facility with which these muscles from an irritation in any one of the three systems, unhappily proceed to involuntary excess of effort, influencing at once, respiration, digestion, and urinary excretion.

* Gaubii Instit. Patholog. Medicin. 542.

SECT. III.

The nature of the Irritation in Asthma; frequently manifest; sometimes obscure.—The continued Asthma of Floyer from manifest Irritation.—Cases of irritation producing Asthma, assented to by medical authorities from their evident offence.

IN some cases of excessive respirative labour the nature of the irritation is declared by concurrent symptoms which admit of no ambiguous pathology, in many others physicians have declared their doubts, if not their ignorance, by resorting to conjecture and theory, which have been ingeniously built on the basis of abstract hypothesis, but which experiment has not yet confirmed, nor dissection ever defended.

The cases of manifest material irritation are enumerated by Dr. Floyer as one species of the Asthma, which he calls *continued*.

This species of Asthma is considered as secondary, and dependent on a primary disease, which is to be removed before the Asthma will submit. But there is some confusion in this arrangement, because the author places amongst the causes of secondary Asthma conditions of the habit which he allows to be symptomatic of the periodic disease, such as the inflation of the colon and the stomach, which is always amongst the symptoms which precede or attend the paroxysm of Spasmodic Asthma.

It is useful however, to advert to the authority of Floyer, in his explanation of the causes of the continued or symptomatic Asthma, because he furnishes a proof of the position which I attempt to establish, that *certain inordinate contractions of the respiratory muscles indicate the presence of a matter offending the pulmonary organ, either by its oppressive bulk, or acrid quality, or both.*

It is not consistent with my plan to dwell very particularly on these causes of Asthma, but a general view may be taken of such manifest and undeniable irritations as have been observed by practical authors, without any important delay in pursuing the other parts of the subject.

Hydrothorax occasions Asthma by the compression externally of the air vessels of the lungs,* and it is also too often the consequence of Asthma, when that disease is inveterate, and the hydrophic diathesis has supervened on the local affection. Vide Carol. Pifo de Morbis ex ferro. p. 217.—Baglivi Praxis p. 107.—Goodwin on animal life and respiration, where is an example of this cause of Asthma, artificially produced. Also Boneti Sepulchret. Anatom. tom. I. p. 515, 516, et insequent.—Mr. Cruikshank on the absorbent system, p. 116.—Morgagni, Lib. 2, Epist. XVI.

Similar to this cause of Dyspnœa is the Hydrops Pericardii. Morgagni, Lib. 2, Epist. XVI.

An Empyema, abscess or large tubercle: steatomatous tumor, &c. in the substance of the lungs or on their investing membranes.

Vide Jacob Wepfer, exerc. de apoplexia. Boneti Sepulchret. Anatom. Mangeti. tom. I. p. 352, 353, 498, 499, 500, &c.—Columbus Lib. XV.—Car. Pifo de morbis a ferro, sect. 3, Cap. 4.—Baillie's morbid anatomy, p. 46, et inseq.

* Vide Haller, ad Boerhaav. Prælect. §, 102. not. 17.

In the instance of a vomica* there is no distinction to be observed, between the manner in which nature attempts to eject it from the lungs, and the efforts which are discovered in the laborious breathing of spasmodic Asthma, to discharge the irritating cause of that disease; after a slight cough a difficulty of respiration comes on, which takes the form of a regular paroxysm of Asthma in many cases, but in all assumes a violent energy at intervals. T. W. has been seized with these symptoms at the approach of two successive winters, and they terminated by the rupture of a vomica, which in the first illness was many weeks before it broke, in the second not so long, nor was the discharge so large; in the interval he was in his usual health; this present winter he has again suffered the disease, and I have had an opportunity of accurately ascertaining its phænomena. The difficulty of breathing commenced after exposure to violent heat, and the vapour of aquafortis in refining gold, a slight cough, but interrupted and useless, attended the dyspnæa; in a few days he perceived an increase of dyspnæa, and great flatulence of the stomach, then a paroxysm of laborious respiration came on in the

* Tulpæ observat. med. lib. 2. cap. x.—Jodoci Lommii Medicin. observat. lib. 2. Hippocrat. lib. 4. epid. 6—4.

evenings, which prevented his continuance of sleep, and returned every night with the regularity of periodic Asthma, from which an ordinary observer could not in the least distinguish the disease, but the difference was to be remarked by attention to collateral symptoms; the pulse was full and hard as in other inflammations, and a pain not pungent but oppressive was felt where the disease lay. In the progress of the disorder the expectoration of fetid pus in large quantity declared the nature of the inconvenience which irritated the pulmonary organ.

Bartholine* gives a very fortunate instance of the cure of a secret vomica, exciting Asthma, and wearing away the body. The patient was wounded by a sword in a duel, the point passed between the ribs and opened the sac. The effusion of pus was attended to, and the patient was restored to health. A brave officer was shot through the lungs at the battle of Quebec, and was cured of his wound, and an Asthma at the same time. It is probable some organic derangement was removed as in the case related by Bartholine.

* *Histor. Anat.* 14. *Centur.* 6. vide *Fernelius Patholog. Lib.* V. *Cap.* X.

Polypous concretions in the ventricles of the heart, and pulmonic vessels, are considered by Hoffman as a frequent occasion of difficulties of breathing. In his Consultations he appears to extend the influence of this state much farther than the general result of Asthmatic Paroxysms will justify. However, dissections have notwithstanding proved that this condition often prevailed, but in some instances if not in all, it may be suspected to have been rather the consequence than the cause of Asthma. See Tulpius Lib. 1. cap. 27.—Riverius Centur. I. obs. 82.—Bartholin de Lact. Thoracic. Cap. XIV.—Malpighius de polypo dissertat.—*Bonetus tom. 1. p. 128, 130, 527, 528, et inseq. Willis de Affect. Hystericis et Hypochondriacis.—Morgagni Epist. XV. XVII. XXIV. XXVI.

Aneurifmal enlargements of the heart and of the aorta; ossifications, earthy depositions and alterations of its structure, are treated of in Dr. Baillie's morbid anatomy of the human body. Morgagni Epist. XVII. XXIV. XXVI.

Calculous concretions in the trachea, and in the substance of the lungs have been met

* Bonetus Mangeti, Lugduni, 1700.

with; also earthy and bony substances.--Baillie's morbid anatomy, chap. iv.—Morgagni Lib. II. Epist. XV. et inseq. Epist. XXIV:—Diemerbroeck Anatom. Lib. II. p. 443.—Bartholin. Anatom. reform. l. 2. c. 9.—Kerkringius Obs. Anat. XXVII.—Boneti Sepulch. Anatom. tom. 1. p. 485, 501, 502.—Fabric. Hildanus, Cent. II. Observ. 29.—Miscell. Curios. Anni. 1671, Observ. 181. In this latter instance there is the remarkable assertion that respiration was not affected. Platerus Pract. lib. I. sect. 2. c. 4.—Schenknius Obs. Med. Rar. lib. 2. —Boerhaave Prælect. in Instit. § 835.—Morton. Phthisiolog. lib. 3. cap. 6.

Bones and other hard substances have passed down the trachea, and created certain Asthma. Tulpii Obs. Lib. 2. cap. 7.

Concretions have been coughed up of different kinds, so large as to create astonishment in the relaters. Koehlerus* speaks of them as very large. Morgagni saw one expelled by cough as big as a peach stone. Æthæus† describes one as large as a walnut coughed up by a girl of fourteen.

Carcinomatous tumours have been dissected from the trachea. Bonet. Sepulch. Anat. Tom. I. p. 485.

* *Commerc. Litter. A.* 1741.

† *Vide Schenknius ad loc. cit.*

Offifications of the pleura, vide Baillie's Morbid Anat. p. 40.

The rings of the trachea have become more or less ossified, the cartilage being converted into bone. In this case, says Dr. Baillie, "the mucus will not be so readily expelled by coughing, as the expirations cannot be so forcible."* See Morgagni, epist. XV.—Tumours in the trachea have been often remarked.

Fat or a tumour of the thymus gland. The thymus has been known in some instances not to diminish as the subject advanced in years; in others it has even increased from disease. Boneti Sepulch. Anatom. tom. I. p. 486. 504.—Baillie's Morbid Anatomy, p. 73.

Gibbosity is a well known cause of difficult respiration. This irritation being permanently and rigidly fixed, either in the sternum or spine, the disease is inveterate as the cause.†

* Morbid Anatomy, p. 59.

† Mr. Chesher, of Hinckley, in Leicestershire, by the adoption of just principles, and the most careful practical deductions from his observations and experience, has attained astonishing success in treating many hopeless cases of gibbosity.

Lommius* says, if a person becomes gibbous before puberty in consequence of Asthma, he dies; in which he follows the prognostic of Hippocrates Aphor. 46. sect. 6. but it is highly probable that Asthma is the consequence of the gibbosity, or at least of an unobserved alteration in the structure of the spine or sternum, which may irritate or disturb the function of the lungs in several ways, before it acquires the term of gibbous. These authors have in that case substituted cause for effect.†

An ulcer in the sternum from a removal of an excrescence, has been followed by Asthma. See Hoffinande Asthmate et Consult. et Resp. Med. Hildanus Cent. 6. Obs. 74.

Adhesions of the lungs to the diaphragm, pleura and pericardium have been frequently found by dissection; these are consequent to inflammation, and it is obvious that Asthma may attend this organic alteration. Bonetus tom.

* Jodoci Lommii Obs. Med. lib. 2. p. 140. Millar on the Asthma, p. 114. Glisson de Rachitide.

† The aphorism of Hippocrates creates considerable confusion in its ordinary interpretation.—Severinus (lib. de Abscessibus) proposes a reading which clears the difficulty and makes the sense more consistent with the opinion above delivered, and with the probable meaning of Hippocrates. For ἐξ read ἐξω and the passage will stand thus, οὐλόσοισι ἔξω ἀσθματος, ἢ βήχος γίνονται, &c. ἐξω signifies *præter* as well as *extra*. The sense will then be “qui præter anhelationem et tussim gibbique fiunt, eos ante pubertatem mori.” See Bonet. de Gibbositate.

I. p. 509, 512.—Bontius Med. Indor. Observ. VII.—Willis Pharm. Rat. part 2, sect. 1, c. 8.—Hippocrat. Lib. 2. de morbis pulmon. &c. Morgagni Epist. XVI.

These adhesions are said by Diembroeck to be found in one third of the subjects opened. Tulpius affirms that the lungs in very few bodies are entirely free from such appearances.

The straining of the lungs by running is mentioned by Floyer, by which injury may happen to the membranes or fibres in the interstices of the air cells. Violent exercise produces anhelation, which will be explained, but it is difficult to comprehend any organic lesion productive of a continued Asthma, or at least it is not to be understood from Floyer's description.

Flatus in the colon and stomach are never absent in the spasmodic Asthma, and if such a state of those viscera is attended with continued dyspnæa, the disease can only be accounted a variety of the other species, in which it will appear that the periods of intermission of the affection are very uncertain, and sometimes are lost in the advanced stages of the complaint, or when it is complicated.

Tumours of the lower viscera, scirrhus, hydropic, steatomatous, or flatulent, mechanically produce Asthma by impeding the descent of the diaphragm. They are also a part of the cachexy which predisposes to the disease not uncommonly. Instances are numerous in practical authors of the mechanical inconvenience of such causes. The gravid uterus is a very general occasion. Ascites and Tympanites produce the same effect. Dr. Ferriér* has a curious instance of tympanites, in which the omentum was found lying in a sac formed in the diaphragm, on the right side of the thorax; Asthma was an inevitable symptom of such a situation of the viscera.

Fat and steatomatous tumours have adhered to the diaphragm.—Vide Veslingius Syntagma. Anat. Cap. 9.—Kerkringius Obs. Anatom. 89.

And also to the pleura and mediastinum. Boneti tom. I. p. 533, et inseq.

The liver has been found of an enormous size by many practitioners. Bonet. tom. I. p. 537 et inseq. And Asthma is very frequently symptomatic of the diseases of this viscus and of the spleen.

The diseases of the mesentery and omentum, if they give occasion to the altered state

* Med. hist. and reflect. vol. I. p. 41.

of the liver and stomach are causes of Asthma. Joh. Rhodius Cent. 2. Observ. 25.—Guern. Rolfinkius Differt. Anat. Lib. 1. Cap. 13.

The liver has been united by adhesion to the diaphragm and lungs. Diemerbroeck Anat. Lib. 1. c. 13.

An hydropic patient was opened in my presence, and the liver was found to contain a large sac of hydatids, which was connected by adhesion to the ductus communis; before this person swelled in the abdomen, he had been for some time asthmatic, and the bile was not passed regularly into the duodenum. Flatulence of the stomach was predominant, and the disease appeared to wear most of the symptoms of spasmodic Asthma. Worms have been found by anatomists in different situations in this viscus.*

The absorbent glands in the posterior mediastinum are subject to enlargement from scrofula. When this affection is considerable it necessarily produces some difficulty of breathing by pressure on the lungs and trachea.† The same glands near the trachea occasionally

* Vide Lieutaud tom. I. p. 194.

† Baillie's morbid anatomy, p. 71.

are converted into bony or earthy matter, and press the passage.*

Diemerbroeck† relates that he saw a live worm coughed up from the lungs of a woman; and has observed these animals by dissection in the vesiculæ of the lungs. He infers that they must have been bred in these cells, for if they had inhabited the bronchia suffocation would have been the consequence, and the most violent cough and Asthma. If they were inhabitants of the cells at the extremities of the bronchia, it must be believed that Asthma would be equally inevitable, though not so ferocious and acute, because the irritation would certainly be less.

Asthma has certainly proceeded from hydatids in the substance of the lungs, on the pleura, diaphragm, and even the surface of the heart. The sudden rupture of these hydatids has produced immediate suffocation.‡—
Car. Piso de morbis a ferro Sect. 3. Cap. 7.—
Boneti Sepulchret. Anat. tom. I. p. 498. 499.

For a curious case of the dilatation of the lower part of the pharynx by which a pouch

* Baillie's morbid anatomy, p. 72. † Lib. II. p. 442.

‡ Vide Ottonem Heurnium obs. 18.—Bartholinum, Cent. II. obs. 61.

was gradually formed, stopping the passage of the œsophagus. See Med. Observat. vol. 3. p. 85.

The sternum and the cartilaginous ends of the ribs have become osseous, and not under the controul of the muscles of inspiration. Bonet. tom. I. p. 533, and Platerus Praxis. Lib. I. Cap. 4. Here is a case of Asthma analogous to any other form of gibbosity.

The mal-formation of the ensiforme cartilage, by being turned inwards as if artificially depressed, is productive of hepatitis and chronic affections of the stomach in a young lady now under my care. Diemerbroeck has particularly noticed the inconveniences from this cause. Lib. 9. Cap. 14.

Bartholine* alledges the effusion of chyle to be a cause of asthmatic affection, in this case he supposes the rupture of a duct.

An extreme dryness of the parenchyma of the lungs has been well ascertained. Rhodius† asserts that it has been occasioned by the profuse use of the decoction of guaiacum wood,

* Specileg. 2. de Vasis Lymph. cap. 2. † Cent. II. obs. XXI.

Avicenna had remarked the condition to arise from the hot vapour of furnaces and metallic fusions. The symptoms are wasting of the flesh, small and frequent respiration, continued thirst, and little spitting. The remedies moist and demulcent.

Heurnius* saw the lungs of a printer so altered as to almost appear like a dried apple.

Considerable deficiencies of substance have been discovered by dissection in the pulmonary system. Vide Senac *Traité du Cœur*, L. IV. c. 3.—Haller's *Opuscul. Patholog. Obs.* 17.

The mediastinum, and even the diaphragm with a large portion of the lungs, have been wanting. Diemerbroeck *Anatom.* L. I. c. 13. This defect was imperfectly supplied by adhesion of the liver to the only lobe of the lungs which appeared. The subject arrived at his seventh year, and it is surprising that he lived so long.

The account of the dissection communicated by the physician D. Wassenauer to Diemerbroeck himself, would have been more satisfactory if the natural history of the boy had been more particularly detailed. We are only told that he was asthmatic all his life, and harassed by

* *De Morb. Pectoris*, Cap. IV.

violent and frequent cough from the slightest causes; a slow fever at length terminated his sufferings.

The extraordinary conformation of this subject was not less curious than that of the celebrated blue boy, whose case is given by Dr. Sandifort, Professor of Anatomy at Leyden.* Here the aorta arose from the right ventricle as well as the left; the pulmonary artery was scarcely pervious to a small probe, and the difficulty of passing it from the heart to the lungs was greater than in the contrary direction. This patient was asthmatical from the second year of his life, which was extended in a miserable series of sufferings to 12 years and a few months.

The circulation through the lungs, impeded by any organic malformation, must be productive of Asthma; and it appears that if the current is diverted from the course of pulmonary circulation, the same effect, in greater or less degree, must happen. Haller says, that the arterious duct is found pervious in the second year, and the foramen ovale has been open longer by his own observation.†

* Vide Observat. Anatomico-Pathologicæ Lugd. Batav. 1777, p. 11. also the Remarks of Dr. Beddoes. Observat. on Calculus, &c. p. 63, et seq.

† Haller, tom. III. 161, 162.

Bartholine* observed the foramen ovale open in *adults* more than once.

Morgagni relates the history of a virgin subject who attained her sixteenth year. She had been sickly from her birth, and affected with extreme weakness; her respiration difficult, and her whole skin of a livid colour. The foramen ovale was found so wide as to admit the little finger.†

In these uncommon instances of organization, Asthma may arise out of the natural avidity of the habit to supply the blood with its oxygen and heat; a process which cannot proceed without inspiration of air; — but that fluid is diverted from taking the course which would expose it to its influence.

The heart must in these circumstances be too little stimulated, and the black blood which it propels from its cavities in a feeble manner, will give anxiety by its delay, and irritate the muscles of respiration to excess of action. Their extraordinary contractions being the natural indication of uneasiness, not only of the lungs, but of all the thoracic viscera and investing membranes.

* Anatom. Reformat. Lib. II. Cap. 8.

† Morgagni de Causis, &c. Epist. XVI.

Though Baglivi was unacquainted with the chemical decomposition of air in the lungs, respiration loses none of its importance in his description of the assistance it affords to the action of the heart. He speaks as strongly of the necessity of its aid to that organ, as if he had discovered the peculiar quality of oxygen, and the difference of black and red blood. Without the exercise of breathing, he says, “*Nullus modo parvus musculus, qualis est cor, centum annorum spatio quo quisque protrahere vitam potest, sanguinis circulationem velociter et interrupte perpetuaret.*”*

Miners are said by Sennertus† to have been opened in whose lungs metals were found of the kind in which their operations lay. Horstius confirms the bad effects said to proceed from the metallic fumes to which artists are exposed, but fancifully asserts, that such complaints are only to be remedied by mineral medicines. He therefore exhibits mercurials, and their cathartic operation was at all events beneficial; diaphoretic antimony succeeded, and the sweats which were produced had a considerable share in taking off the inflammatory con-

* Baglivi de Sanguine et Respiratione.

† De Conf. et Dissensu, Cap. IX. vide Horstius, Obs. L. 7. Obs. 25.

dition of the lungs. See Sennertus Pract. Lib. II. p. 2. Cap. 2. — Bartholin. Cent. 4. cū Theod. Schenkus, Epist. 72.

Stone cutters and cleaners of feathers receive the matter which is suspended in the air into their lungs, and become Asthmatic. Diemerbroeck, Lib. II. p. 443.

According to Sylvius,* the parenchyma of the lungs is sometimes dense and corrugated, occasioning dyspnœa. He attributes this state to the restraining quality of the blood, but we are under no compulsion to accept his theory. It may be attributed, with great reason, to preceding inflammation.

Hoffman describes the vesicles in this disease, “ Quasi carnea, crassa, rubicunda, substantia infarctas.”

Morgagni† says, the matter filling the lungs is like the substance of the liver. Senac‡ confirms this description of the condition of the lungs. But there is some disagreement amongst authors on the species of inflammation to which it is owing. After all, Pneumonia is the most probable, as described by Dr. Cullen.

* Sylvius de la Boc. Praxis. Lib. I. Cap. 23. § 17, 18.

† De Sedibus, &c. Epist. XXI. ‡ Traité du Cœur. L. IV. Ch. 3.

Dr. Baillie adds his testimony to the fact alledged by these authors. He says, “The
 “ substance of the lungs has in this disease
 “ nearly the same solidity, and the same gene-
 “ ral appearance as the liver. When ex-
 “ amined more minutely the air cells appear
 “ to be filled with a brownish solid matter.”*

Flatus are said to distend the lungs, but I cannot comprehend this curiosity. These flatus are said to be carried by the lacteals to the lungs, and to arise from the ferment of the succus pancreaticus, &c. For further information the reader may consult Reg. de Graaf de Succo Pancreatico, Cap. 9. and also an author nearer home, Floyer passim. A nobleman, says Rhodius, † died of a diarrhæa cum suspirio. The lungs were so swelled with wind as to fill the whole cavity of the breast.

Sylvius‡ assures us that flatus make their way every where. And Mr. J. Hunter§ coin-

* Morbid Anatomy, p. 52. † Observat. XXII, Cent. 2.

‡ Lib. II. Cap. 21. § 19.

§ See Animal Œconomy. The phænomenon asserted by the ingenious anatomist is very plainly described by Sylvius (loc. citat.) Flatus,—“ Observantur quoque excludi per Uretham: sic
 “ qui ad Uterum sunt delati, aut in ipso geniti per ipsius cervi-
 “ cem utramque observantur erumpere, atque foras exitum in-
 “ venire!”

cides in his opinion, as we may presume from his account of the explosions from the vagina. Notwithstanding these authorities, it may perhaps be most prudent to rely on this fact, that the blood contains no detached masses of air.

It may be believed, however, that the lungs are susceptible of a diseased growth, and such instances are well ascertained.*

I opened the thorax of an hydropic patient, and found his lungs of a monstrous size, very pale, and free from any other disease. The heart was, however, loaded with excessive fat; and these organs seem to have robbed the liver of its nourishment, for that viscus was particularly small. The patient had laboured under dyspnœa for many years.

The suppression of evacuations of blood, as the menstrual or hæmorrhoidal flux; by which the lungs are necessarily oppressed with the redundant fluid. See Floyer, p. 96.—Hoffman Consult. and Respon. Cent. I.—The difficulty of breathing, from this cause, is more entitled to the name of dyspnœa, and may precede either Asthma or Phthisis. Vide Schneiderus de catarrhibus, Lib. III. Cap. 6.

* Sylvius Praxis, Lib. I. Cap. 24. § 12.

Acrid exanthemata repelled are a cause of Asthma, assented to by practitioners; there is no difficulty in supposing that the matter of those herpetic eruptions, which were manifest to the senses when seated on the external skin, is deposited on the lungs or their investing membranes, when the external disease suddenly disappears. The same observation applies to other eruptions, whether attended by pyrexia or not. Phthisis follows their repulsion as well as Asthma. See Floyer, p. 100.

An instance of relief from the eruption of small tumours which appeared externally, is recorded by Dr. Stark. Clin. et Anatom. Observ. p. 44.

Upon the same principle, as exanthemata are said to produce Asthma, the gout atonic or retrocedent may create that affection, and frequently does. In both instances the critical and natural deposition should be made on the surface or extremities of the body. See Hoffman de Asthmate, et Consult. et Resp. Med. Cent. 1.

A viscid mucus secreted by the glands of the trachea and bronchia, and loading their follicles, necessarily impedes the free admission of air, and irritates the organ. This spe-

cies of Asthma approaches by imperceptible shades of distinction to the character of periodic convulsive Asthma, but as depending on a cause which is sufficiently manifest to have attained the assent of medical observers to the force of its impression, it is classed with other cases of the continued or symptomatic Asthma of Floyer, or Dyspnæa of Cullen. The latter writer called it Dyspnæa Catarrhalis, and Hoffman Asthma Pituitosum, vide Tom. III. Sect. II. Cap. 2. § 3. Also Willis Pharm. Rat. p. 2. Sect. I. Cap. 12.

Catarrh is attended with disordered respiration, but is always a febrile disease, and therefore its termination may be calculated when its attack appears.

Polypi of tenacious matter have been the occasion of Asthma when the air vessels were filled with this substance. Secretions of this viscid material induced some writers to take the erroneous opinion of vascular tubes being discharged, but the case has been explained with peculiar simplicity and distinctness of comprehension by Dr. Warren in the first Volume Transactions of the College of Physicians. Art. XVI. of the Bronchial Polypus.

A more particular account may be obtained of organic derangements of the thoracic and abdominal viscera, leading to or inducing difficulties of breathing, by consulting Morgagni and Bonetus.

There are also numerous detached facts in the different journals, foreign and domestic. These are in every body's hands, and it would be no compliment to the medical enquirer to extend our references to a greater length.*

If, however, curiosity prompts the reader to further examination, he should not neglect the natural history and dissection of the celebrated Thomas Parr. For this he may consult the Transactions of the Royal Society for 1668, 1669, and then proceeding to Bonetus he will be gratified by the opinion of that author, that after a man has lived 152 years and 9 months, he may die of a difficulty of breathing and inflamed lungs.†

These causes of continued Asthma have been assented to as inducing the disease, by

* The medical latinity of the writers referred to will seldom be admired for the clearness of its construction, much less is it to be expected that the classical purity of a Baker is infused in their compositions. It may, however, be safely asserted, that the facts which are to be found in their works are entirely deserving of consideration, and that they will lead to views of practice, which without this light, would be neglected or contemned.

† Boneti Sepulchret. Anatom. tom. I. p. 490.

obstructing the action of the lungs by the compression of their bronchia or vesicles, by hindering the descent of the diaphragm, so essential to the enlargement of the cavity of the breast; or finally, by some medium which is not satisfactorily explained without considering it as an *irritation* to recover or obtain a condition of the organ, unencumbered and free to exercise its healthy function.

 SECT. IV.

Dyspnœa of Dr. Cullen comprizes cases of continued Asthma of Floyer.—Under this name the disease preserves its character in a milder form.—Anhelation an acute case of Dyspnœa, proceeding from violent or rapid exercise.—The muscles of locomotion and respiration do not readily encrease their actions at the same time.

DR. Cullen follows Sir J. Floyer with great attention in the idiopathic species of Asthma, but he finds an imprudence in deserting the strong indications of laborious respiration, which point to the cause of the disease in the continued species of Floyer, or what has been commonly termed the symptomatic Asthma. He therefore excludes most of these cases from the genus Asthma, and places them, with many

* Nosol. Method. G. IV. and L. VI.

others, under the genus *Dyspnæa*: but a new name will not alter the arrangements of the animal œconomy, nor disguise the phenomena of nature in her distress.

In *dyspnæa*, the species still depend on some cause which irritates the organ by its obstruction or acrimony, and excites the complaint. Under that head in the nosology the cause frequently is made to distinguish the varieties by a trivial addition, and it is strictly unreasonable to attribute degrees of the same affection to distinct essential origins.

Whenever there is a difficulty of breathing there is an excess of respiratory actions, which always is occasioned by irritation, but the proportion of that excess will be commensurate with the force which excites it, and the ratio of the irritation will be compounded of quantity and quality, in degrees not always to be ascertained;* still we must not forget that “*Majus aut minus non variat speciem.*”

Dyspnæa is considered by Hoffman as transitory, and without danger.† It attends com-

* The cause is here supposed to be applied to a habit in which the standard of nervous sensibility is moderate and common to subjects not advanced far in the disease. Accumulated irritability produces, or is attended by, increased sensibility to stimuli; and habits of morbid contractions of muscles are a disorder when the primary irritation is removed.

† Opera, tom. 3. Sect. II. Cap. 2. § 3. Willis Pharm. Rat. Part II. Sect. I. Cap. 2.

monly on the corpulent, fat and plethoric, who sustain this affection most when the body is put in motion. It may be called a slighter Asthma, in which the convulsive motions of the respiratory muscles do not appear, but there is an effort of painful respiration, which comes on, not with regular periods, but according to the occurrence of exciting causes. It is a state which discovers very generally the predisposition of the body to the more violent affection which it often precedes. Too great fullness of the pulmonary vessels is the most frequent cause, because then the blood passes with some delay to the left side of the heart, and this happening in a habit, which, from the causes to be explained hereafter, is relaxed in its vascular structure, the contractile tone of the artery is weak, and unable to withstand the distending force. Dyspnœa in this view is excited by compression of the vesiculæ and bronchia by the pulmonary vessels, which do not allow a perfect dilatation from inspired air, and distress the organ.

If in this previous condition of the lungs the circulation is accelerated by an accidental cause, the accumulation in the pulmonary vessels is intolerable, and it is because these vessels are of a structure not thin and tender, but dilatable, that rupture is not the conse-

quence. But though the constitutional predisposition enables them to escape hæmorrhagy of red blood, these vessels must be relieved, and under violent distress, connecting this affection with Asthma, they effuse their serous contents into the vesiculæ of the lungs, and their general distention becomes less.

It is therefore obvious how Dyspnæa may result from inconvenience to the pulmonary function, and how it may in its progressive causes assume the character of Asthma.

It has already been stated that suppressions of customary evacuations of blood, materially lead to this condition of the vessels of the lungs creating Dyspnæa.

That suffocative sensation which is brought on by rapid exercise is a more acute case of Dyspnæa. Its immediate cause is similar, though the remote ones had not influenced the habit. Nosologists, ever fond of refinement and separating effects from their parent cause, have called it Anhelation, a term which very well marks the appearance of the affection.

When a person is said to be "*out of breath*" from violent exertion of this kind, the blood has been accelerated from all parts of the body to the heart, that organ is stimulated to discharge it through the lungs to the left side,

and its contractions are quick in proportion to the frequency with which this stimulus is renewed. Under this rapid circulation inspirations of air are ardently desired by the pulmonary system, but the exertions of the locomotive muscles seem to check the efforts of those subservient to inspiration; and to prevent the respirations being encreased in the customary proportion to the pulsation of the heart and arteries. If *18 respirations usually accompanied 70 pulsations of the heart, 140 pulsations should be attended by 36 respirations, but it is certain that this balance is lost in violent exercise.

When the action of the locomotive muscles is suspended, that of respiration continues and is even encreased, fuller and deeper inspirations are obtained and the blood being more readily passed through the lungs, because the organ is more perfectly expanded, relief of the distress for breath takes place, or rather a sense of suffocative irritation is removed. During the violence of motion the expirations discharge more air than is restored by inspirations, the muscles acting in inspiration being liable to relax, whilst a

* This number seems to be too great, though taken for calculation. Haller makes 8 pulsations to correspond with one respiration of a healthy man, a proportion too small. Vide Haller ad prælect. Boerhaave. DCXXV.

A different set of muscles are in an uncommon series of contractions, but the great impetus of the heart prevents that collapse of the pulmonary vessels which is produced in natural expiration, so that in this temporary artificial Asthma, there is no interval to be calculated between the reception of the pulmonary blood in the left ventricle, and its discharge from the right. The effect of such a state must be a continual fullness of the pulmonary vessels, a natural nifus to expand the air cavities, that the oppression may be removed from the organ, —but an inability to give relief till the other muscles of the body are at rest, when the heart will not be so incessantly stimulated by the arrival of venous blood, and nature can put in exercise the muscles of respiration.

This Anhelation may be justly said to be excited to relieve the organ of the blood which unusually distends the vessels, and is truly an irritation of the lungs. Haller* points it out as the efficient cause of the whole process of respiration in a moderated and natural degree, but if a sense of suffocation originally excited the exercise of breathing, and if the function continues to be supported by the living animal through the habitual, and therefore impercep-

* Elem. Phys.

tible operation of the same cause, the extreme case of too violent and morbid repletion of the vessels may be well supposed to excite a proportionate action of the respiratory muscles for the same end.

This distress from violent exercise is however most oppressive to those who have not been in the use of it, for habit will not only enable a person to act with his locomotive muscles in considerable increase of vigour, but to accompany their exertion with more respiratory action than in others who have not pursued it. In these also the vessels will not be so subject to partial dilatation, and the fluids contained will be more equally disposed of through the superficial capillaries of the body; but where is the instance to be found of education or habit having entirely overcome the influence and consequence of some irritation from this cause?

Mr. Hunter* has an observation, which appears to attribute the being out of breath in exercise, to the deficiency of air taken in, in proportion to the accelerated motion of the blood, and he thinks that in exercise we probably breath less air: true! but there is no apparent deficiency of oxygen, for the blood of

* Vide the Animal Œconomy, p. 97.

a person who has been so moved, being drawn is as florid, and probably more so, that after a state of rest; in fact, though the inspirations are not in proportion to the pulses of the arteries on this occasion, yet the mass of blood passing more frequently through the lungs, cannot want the opportunity of imbibing oxygen, which may not so completely enter into new combinations in the capillary vessels, during this artificial state of circulation. To say that a person breaths quick or laboriously because he is out of breath, or wants breath, is surely giving little satisfaction to the physiological inquirer.

The want of air in the lungs is therefore the natural propensity to imbibe it in proportion to the quantity of blood which has usually passed through the lungs in a given time, and because the vessels are morbidly stimulated by their unusual contents, this propensity assumes the activity which attends irritation. The vessels are then too turgid, and therefore compress the air vesicles, but independent of this condition, the inability of supplying the organ with its requisite measure during the act of violent exercise of the locomotive muscles, stands upon the simple basis of a natural law, that certain systems of muscles are not readily brought into action when other systems are

employed, though habit and repetition will diminish the difficulty. Therefore the muscles which serve inspiration, are not without practice induced to take extraordinary action, when the muscles of locomotion are vigorously contracted.

M. Girtanner* adduces the contractions of the heart in support of his doctrine of the laws of irritability. "The heart contracts
" from the stimulus of the blood, and impels
" the blood through the arteries; it then again
" dilates and the blood enters. But the heart
" does not contract itself immediately upon
" the first impression of the blood. Its irritability having been lessened by the preceding
" contraction, it requires half or three quarters
" of a second before the irritability of the heart
" shall have accumulated to such a degree
" that the new stimulus can act upon it."—He then says it is impossible to explain the motion upon any other principle, and that Haller's irritability of the heart is insufficient to account for its systole and diastole. For, says this critic in physiology, assuming the objections of the opponents of Haller, "If
" the blood acts upon the heart as a stimulus,
" and its contraction is the consequence of

* See Girtanner's two Memoirs in Dr. Beddoes Obs. &c.

“ such action, how comes it that the heart
“ does not contract as soon as the blood enters
“ it, but that it flows in some time before the
“ contraction is renewed? why does not the
“ effect immediately follow the cause? Haller,
“ he says, could never answer this objection,
“ because he was a stranger to the laws of irri-
“ tability.” But is not this objection answered
by the tenor of Haller’s doctrines, and by the
accepted truth of physiology? the blood stimu-
lates the irritability of the heart by its com-
pound force of quantity and quality. When
it begins to flow into the right ventricle there
is a progressive accumulation of stimulus, but
it must arrive at its acmé before the contraction
is excited by its power. Distention of a hol-
low muscle is a stimulus to its irritability, but
can the heart be expected to be influenced by
it before the stimulus has obtained a certain
degree in its progress. Whatever then may
be said of the quality of the blood, this disten-
tion being a part of the compound force, the
heart will not be impressed to contract itself
from the influx of a minute quantity, but if the
return of the blood is violently accelerated and
the compound stimulus is rapidly renewed,
the contractions of the heart correspond with
the impression made upon it, and half or three
quarters of a second are not necessarily the in-
tervals of its rest.

If Haller was a stranger to the laws of irritability as given in the memoirs of Girtanner, he was well acquainted with the force of impressions on animated matter.

The author of this inquiry heard the elucidation of these laws, delivered in the year 1780. But the *Elémenta Medicinæ*, of Dr. John Brown are a substantial record of the title which that philosopher had to the principles delivered in these memoirs as new.— Science should frown upon the attempt which the writer has displayed without delicacy and feeling, by which posthumous celebrity, too often the only gift which genius can hold in view to incite its efforts, and invigorate its powers, is to be ravished from its just possessor. The acrimony of medical schism expired when Brown retired from persecution and the world. The opponents of his system, may now acknowledge the advantage of pursuing some of his hints, and of adopting many of his conclusions. To their justice the appeal may be made from the claims of Girtanner, and let their fostering attention to the reputation of the dead, continue to animate the philosophical ambition of living merit.

Practical Inquiry

ON

DISORDERED RESPIRATION.

PART II.

PART II.

CONVULSIVE ASTHMA.

SECT. V.

The progress made in this inquiry.—Asthma from irritation not so apparent as in the continued species.—The PERIODIC FLATULENT of Floyer ; the SPASMODIC ASTHMA of Cul-len.—The disease described.—Its proximate cause investigated.—The path which was followed in the inquiry after the cause of the manifest species pursued in treating of this.—Symptoms and indications generally the same.—Sir John Floyer's case.

I Hope that some ground is now gained in the inquiry after the immediate cause of that affection of the respiratory muscles, which in a slight degree has been termed Dyspnœa, and in a more severe degree Asthma. It has appeared from the analogy of violent contractions in

other organs, that the irritation of extraneous matter in the lungs may be consistently believed to excite similar contractions of these muscles. The affection of respiration has even been traced both in Dyspnœa and Asthma to a material, which could not fail, by its offending properties, to irritate the pulmonary organ, and disturb its functions. In many instances of successful effort to eject the oppressive substance, the energy of respiratory labour has ceased, nor would it ever continue after the exciting cause is removed, but from collateral inconveniences which it may have induced by the violence and repetition of primary irritation, and which are referable sometimes to the laws of muscular association and habit, at others to the alteration of organic structure, which may occasion new cause of disturbance.

But there is a distinction taken by * Sir John Floyer in which he separates the affection which is occasioned by a manifest inherent cause, from that in which the cause is not so obvious to his senses. The latter he calls “the Periodic flatulent Asthma.” † Willis terms it “Asthma Convulsivum.” ‡ Hoff-

* Floyer, Chap. 1. † Willis Pharm. Rat. P. II. Sect. I. Cap. 12.

‡ Hoffman, III. 94.

man and *Cullen, Convulsivum et Spasmodico-flatulentum, or, Spasmodic Asthma.

The last author makes three idiopathic species under this genus, of which the first seems to be nearest to his interpretation of the generic disorder, though he does not propose it as a specimen in preference to the others.— This species is spontaneous, “ sine causa manifesta vel alio morbo comitante.” The second is *Asthma Exanthematicum*, which proceeding expressly from the retrocession of an exanthematous acrimony, may justly and without delay, be attributed to material irritation, with other cases which have been remarked under the Dyspnœa of Cullen, and the Continued Species of Asthma of Floyer.— The Asthma Plethoricum arises from a suppression of usual evacuations of blood, or from a spontaneous plethora. It is true that such a state of the pulmonary vessels may exist, as, by compressing the vesiculæ and bronchia, may impede their perfect expansion, but I have taken the liberty of calling the affection derived from that cause dyspnœa, or a slight Asthma, because, unless it has proceeded to the degree which produces effusion of serum from the exhalents, it does not periodically excite

* Nosolog. Method. G. LV. Practice of Physic, MCCCCLXXIII.

the convulsive and laborious respiration of a paroxysm.

It is the disease which comprehends the above idiopathic species, which Cullen thinks is alone properly called Asthma, “ as it depends upon a peculiar proximate cause, and “ has peculiar symptoms.” This is the periodic flatulent, or spasmodic Asthma, which is to be treated of in a more particular manner.

The attack of a paroxysm of periodic or convulsive Asthma is preceded very generally by Dyspepsia, and the circumstances which occur to a relaxed habit. This condition of the body may have prevailed for months or years before it assumes the additional form of Asthma, but when that disease is commenced, the symptoms of Dyspepsia never fail to become aggravated, and to shew themselves with violence before the fit. These symptoms are flatulence and distention of the stomach and bowels; a heavy pain over the forehead and eyes; eructation of wind, with water which is sometimes insipid, at others sour.—When the evening approaches this weight over the eyes becomes more oppressive, and the patient is very sleepy. Occasionally, if particularly animated by company and conversation, the drowsiness does not take place, but a shortness of breath is perceived, and soon after

much anxiety of the præcordia, with great restlessness. The presence of company then becomes irksome, as it seems to increase a certain heat of the body, a want of free respiration, and an irritability which repels the most cautious attentions of friends. Frequently at this period there is a tingling and heat in the ears, neck, and breast, and a motion to expel the contents of the bowels is attempted with some violence, and with great uneasiness of the abdominal muscles. When an asthmatic feels these warnings he may be convinced that his enemy is at hand.

At some uncertain hour before midnight the patient is sensible of the violence of the disorder; most frequently after a slumber in bed he awakes with great difficulty of breathing, and feels the necessity of a more erect posture of his body. Inspiration is performed with great effort of the muscles subservient to that function, but is never perfectly deep, and the diaphragm seems to descend with great difficulty against an opposing force.

There is now a desire of free air, speaking becomes distressing, and the irritability of the mind continues, but is not so acute as in the approach of the fit. There is great straitness of the chest, and a wheezing sound in respiration. An inclination to cough shews itself,

but it is small and interrupted. The pulse is increased in quickness a few strokes, but there is no hardness in the pulsation. No preternatural thirst, unless, as often happens, the fit is excited by the presence of indigestible matter in the first passages. There is a propensity to make water, which is discharged copious, frequent and pale.

After some hours of distress the patient perceives his anxiety to be less, the breathing less quick and laborious, the inspirations longer and more full, the expirations still attended with wheezing; the pulse not so quick and more open, irritation less acute. The cough probably brings up a portion of phlegm, and a very sensible relief follows that excretion. Then the tranquil state of the feelings introduces sleep, but not unaccompanied by wheezing, which continues almost always through the first night, and until, by the progress of the fit on the second or third day, a more considerable expectoration of mucus takes place.

The second day is ushered in by a remission of the symptoms which the patient perceives from the time of awaking in the morning. No change of posture, is however, yet performed with impunity, and particular distress will affect him, if he engages in the

fatigue of dressing whilst the stomach is empty. The pulse will be accelerated more than it was in the acmé of the paroxysm, and motion must frequently be suspended, or a vehement agony for breath will certainly supervene.— During the day if no particular hurry occurs, the breathing becomes gradually more free till the evening, an inexperienced Asthmatic even flatters himself that his disease is retiring, but he finds at the approach of night that he must sustain a new attack. The paroxysm recommences with the usual symptoms, and the night is passed nearly as the former, but the sleep is more perfect and productive of more relief.

The third day, the remission is more complete, there is some additional expectoration, and motion is exercised with less distress, but still with great inconvenience. After the paroxysm has renewed its invasion in this manner for three nights, expectoration generally becomes free, but there is no certain termination of the fit at a fixed period. However, except in particular cases, it goes off after a few days. And as the daily remissions become more perfect, the urine becomes higher coloured, and in smaller quantities; the expectorated mucus is more copious and digested,

strength of pulse and vigour of action encreases, and good humour and sunshine again enliven the mind.—The expectorated mucus has been said to be streaked with black, or to have a blackish tinge, and this appearance certainly prevails in many instances, but not invariably. The taste of the expectorated mucus is also equally uncertain, sometimes sweetish, but most frequently saline, and occasionally coloured minutely with blood.

There is considerable variation in the time of accession of the paroxysm, and the length of its duration, the intervals between the fits, the quantity of mucus expectorated and the freedom of that discharge. These circumstances of the disease will be influenced by the predisposing causes and concurrent accidents. The disease appears to invade all temperaments, but, I believe more particularly the melancholic, or that which is intermediate between the melancholic and sanguine. The sanguine being in fact more liable to fall into phthisis.

In the progress of this inquiry other circumstances belonging to the paroxysm by casual attachment, will be occasionally described.

In examining the symptoms of the paroxysm of this disease, we find some uniform and constant, and others generally occurring, but with uncertainty in proportion to the various fluctuating and accidental influence of predisposing and exciting causes.

The symptoms which are sufficiently constant to distinguish it are described by Dr. Cullen in his Nosology.

“ A difficulty of breathing coming on at intervals.

“ A sense of straitness in the chest.

“ A wheezing in respiration.

“ Cough in the beginning of the fit, difficult or none; towards the end free, and attended with expectoration which is often copious.”*

In endeavouring to find the cause of these symptoms, I shall attend to the steps which have already led me to the source of similar appearances in disorders of respiration before treated, and I shall assume the probability of finding a cause similar in its properties of acrimony or bulk, by which the energy of the

* Asthma. Spirandi difficultas per intervalla subiens; cum angustia in pectore sensu, et respiratione cum sibilo strepente; tussis sub initio paroxysmi difficilis, vel nulla, versus finem libera, cum sputo mucis sæpe copioso.

Nosolog. Method. G. LV.

respiratory muscles is irritated into excess of action.

In those disorders a material was excreted, or a compressing force was removed, before the extraordinary contractions of the muscles was suspended, or finally made to subside. In some cases a mechanical inconvenience, as in the instance of a gibbous spine, could not be expelled, and then the proportion of irritation which it was calculated to give, continued in action, and the disorder of respiration did not cease.

In such circumstances the indications were natural, and entirely coinciding with the laws which govern the animal œconomy. They would have afforded *prima facie* evidence of something which nature was desirous to discharge, even if the offensive substance had not been exposed to the observation of the senses.

Having ascertained such outlines and signals of direction, we are impelled to follow the path in which nature is our guide; and we are encouraged by the acknowledged simplicity and uniformity of her laws, to expect that the same principle of *irritation* has excited her efforts in one case of Asthma, as in another, though it may be more retired from our view, and wear a different form.

Inductive reasoning, says Dr. Crawford,* is defended by the confidence and reliance of mankind, and universal experience assents to its evidence when applied to the phænomena of nature, depending on general and simple laws.

But notwithstanding the security which attends this road to the discovery of truth, the remark of Dr. Ferriar,† is unfortunately too capable of defence by the general practice of medical investigation. We have not yet sufficiently attended to the injunctions of Bacon, and it may be added, we are not enough chastised by his rebuke to follow his method.

If this complaint is not well founded, why have authors resorted to conjectural theories in preference to apparent indications of sensible appearance in explaining the cause of Convulsive Periodic Asthma?

In this species of Asthma it appears, by the diagnostic symptoms of nosologists, that the same efforts of the muscles of respiration are exerted as in the Continued Species of Floyer, in which the paroxysm does not subside into a perfect intermission, and that in general a con-

* Exper. and Observat. on Animal Heat. p. 65.

† Med. Hist. and Reflect. Introduction.

tinuance of too much action of those muscles is the only distinction to be perceived in the latter species, as far as regards external phenomena.

It appears, therefore, more divested of hypothesis, to have inferred that similar effects have proceeded from the operation of similar causes, and to have combated the distinction arising from the permanence of the symptoms in one species, and their suspension in the other, by adverting to the powers of the animal system, and examining if those powers furnished a means of silently, but efficaciously removing the particular irritation which the data might have suggested to be the occasion of the Periodic Asthma.

Is there any exclusive mystery in the formation and motions of animal matter but what results from the vital principle? And when it is animated by this principle, does the compound cease to be directed by its author and creator through the medium of the wisest laws, the system of which is "*Nature?*" A code of rules to which all creation is subjugated by the CAUSE OF CAUSES.

Physicians have not the power to pursue the investigation of a cause producing certain appearances in the animal machine, without tracing those appearances with constant re-

ference to the laws of the œconomy of life, any more than the general philosopher can take a latitude independent of immutable principles in reasoning on the natural objects of his inquiries. “ By the rules of philosophizing,” says Dr. Crauford,* “ we are to admit no more causes of natural things than such as are both true and sufficient to explain the appearances.” Nature does nothing in vain, and having exhibited to us any one cause of an operation, we are not fruitlessly to speculate on complex causes of that effect. This admonition is enforced by Sir I. Newton, when he says, “ Frustra fit per plura quod fieri potest per pauciora.”†

Sir J. Floyer describes the *Periodic Asthma* in a manner which leaves no doubt of all the powers subservient to respiration having been employed with excess of energy in that, as well as the *continued species*. “ The diaphragm is not without much difficulty moved downwards; but for enlarging the breast in inspiration, the intercostal muscles, which serve for the raising of the ribs, and lifting up the breast, strive and labour more vehemently; and the scapular and lumber mus-

* Exper. and Observ. on Animal Heat. p. 366.

† Vide Newtoni Principia, Lib. III. p. 202 et 357.

“cles, which serve for strong inspiration, join
“all their force, and strain themselves to lift
“up the breast and shoulders for enlarging
“the cavity of the breast, that the lungs may
“have a place sufficient for their expansion,
“and the air more plentifully inspire.”*

Here is sufficient evidence of distress in labouring to accomplish some object, but Floyer, who had personal experience of the disease for thirty years, had not begun to consider the effort as the energy of nature in endeavouring to remove a material offending the pulmonary organ.—This can only be accounted for by supposing that he was influenced by a preponderant theory, and that observing in some very few instances of the disorder no excretion of mucus or other extraneous matter, he was discouraged from following to their source symptoms which attended in consistent uniformity the progress of general cases: and we shall be still less surprised at his deficient deduction from facts, when we reflect upon the small advances which had been made in the knowledge of the absorbent lymphatic system, the active power of which is exerted with such important effect in the removal of serous effusion in every cavity of the body. But since

* Floyer on the Asthma, p. 7.

the time of Floyer physiologists have referred, with more precision, the occasional increase of powers to the urgency of any obstacle to the freedom of pulmonary action. In those cases, says Haller, the muscles inserted into the thorax, clavicles and scapulæ, unite their force. “*Scaleni musculi, mastoidei, trapezii, pectorales, tum levatores parvi, quos ex anatome oportet repetere.*”*

That a proportionate addition of energy incites the absorbent vessels into action when the lungs are threatened with suffocation, appears from the observation of Mr. Cruikshank.† “*I have repeatedly seen in animals dying of hæmoptoe, and in the human subject itself, the lymphatics of the lungs, which at other times contain a transparent fluid, turgid with blood, which they had absorbed from the air cells.*”

Motions performed with great energy are therefore strong indications of some injury to be averted, or some offence to be removed. And as in the Periodic Asthma, the cause is not so indisputably conspicuous as in the Continued Species, I shall take advantage of these indications, and apply them as the best direction which an obscure disease affords.

* Pr. Lin. Physiolog. CCLXIV.

† On the absorbent vessels, p. 42.

✓ They point to an *irritation* in the pulmonary organ, and from the preceding sections I am led to suppose that this irritation may be *material*. I therefore consider if any excretion of matter favours the supposition, or if any appearance of offence constantly accompanies the progress of the disease, and vanishes when the disease disappears; or, being occasionally absent, if its absence can be accounted for by certain known and accepted laws of the animal œconomy.

SECT. VI.

The presence of mucus in Asthma.—The origin of this serous fluid.—The observation of writers on this symptom of the disease.—The earliest medical Authorities.—Hippocrates—Galen—Alexander Trallianus.—The Arabian Physicians.—Remark of Willis and criticism of Morgagni on the opinions of the antient Authors.—Medical writers of the 16th and 17th centuries.—Jodocus Lommus—Sennertus—Riverius—all acknowledged the excess of Serum in Asthma, and made it a cause of the disease.—The doctrine of Willis founded on this condition of the fluids.—Considerations on the authority of Willis.

“SÆPE sæpius miratus sum,” says Willis,
 “quid fiat de effluviis vaporosis, quæ perpetim e sanguine in præcordiis efflagrante copiosissime et nonnunquam impetuosissime dimanant.”

The excretion of mucus is a symptom of so often attending the convulsive Asthma, that it could scarcely have escaped the particular observation of modern physicians, and the secretion of it have been considered as the prin-

cipal cause of the disease, but from the obstacle of some few cases having occurred, in which no expectoration appeared, and of some others where it was not considered equal to the effect produced.

These instances of Asthma have however been very uncommon, and may be shewn to have depended on the same proximate cause embodied in a more subtle form, or the absence of the excretion of mucus may admit of satisfactory explanation in the laws of the animal œconomy: at the same time the general presence of accumulated fluid in the lungs is a part of the disease, conspicuous whilst its symptoms remain, the matter is excreted from the bronchia as the paroxysm declines, and is expelled freely and copiously in most cases at the termination.

This matter is separated upon the membranes of all the cavities of the body.* Where those cavities have external openings it is not coagulable by heat, but where there are no external openings it is coagulable in the heat of boiling water.

* Οἷον serum and lymph are not proved to be different from mucus, and distinctions can only be taken according to the consistence of the fluid. They are equally the watery part of the blood, separated in a condition more or less morbid.

Its quantity in general will be found to be regulated by the vigour of the animal, because the power of absorption bears a relative proportion to his strength or weakness.

An acute physiologist makes the following distinction : “ In diseases where the contraction of the vessels is too great, there is scarcely as much moisture in the cavities or interstices of the parts as allow them to slide easily one upon another. In health the quantity of such liquors is moderate, and a pretty constant equality is kept up between the action of the exhalents and absorbents: but when the body turns weak the exhalents pour out so much more than the absorbents can take in, that all the cavities are found to contain considerable quantities of liquors.”*

The presence of such liquors in the lungs, and the natural process by which their morbid accumulation was to be prevented, was conceived; though not fully explained by the sagacious Willis, who says, “ loculi, seu spatia ista inania ubique ex omni parte disponuntur, quæ vapores in pulmone occlusos excipiant, et eosdem mox condensatos per lymphæ ductus, quasi per totidem alembici rostra extillant.”

* Alex. Monro, Sen. Works, p. 377.

But such effusion of lymph on the membranes, and in all the cavities of the body, is allowed to be necessary to health, in a moderate proportion, and occasionally to be increased to a morbid accumulation when disease has lowered the tone of the animal system. In the application of its influence to the production of Asthma, the authority of former writers may naturally be consulted. In examining such authority, we must however be careful to limit the extent of evidence to the historical detail of sensible appearances, excluding a partial bias to the attraction of prevailing theories, or aversion from those which are exploded. The former may not consist with the evidence of natural facts, and the latter ought not to involve in the fate of their disgrace the record of phenomena, which experience has rather strengthened than opposed.

Without minutely searching the writers of all ages to ascertain their sentiments on Asthma, a task little profitable, and still more unentertaining, I shall slightly exhibit a specimen of the testimonies of those who had weight at the different periods in which they flourished.

From these examples we may fairly infer what would be produced by a more extended investigation ; in fact, the cotemporary writers, and those who followed the authors whom I here adduce, coincide with great fidelity in the doctrines of their brethren, and as far as I have been able to pursue the inquiry, no variety of description sufficient to invalidate the above remark is to be discovered.

The cerebrum was supposed by Hippocrates, and the earliest physicians, to be the grand receptacle of pituitous humour. Here were the vapours arising from the stomach, liver, and lower viscera sublimed, and then by the coldness of the brain, condensed into the fluid which constituted pituitous matter : these, physicians called the head, the author, and chief residence of all defluxions.

From whence could this theory take its origin but in observation which witnessed in many diseases of debility and excess of serous humour ? In catarrh the first discharge was from Schneider's membrane : and in many more important complaints the first symptoms were attached to the head : the severest disorders of the body, when these were marked by accumulated secretion of lymph, be-

came connected with the prevailing opinion of the functions of the brain ; but this opinion could only apply where excess of serum was an evident symptom in the disease.

Galen makes two causes only of Asthma; each distinguished by a material involving irritation, thick and pituitous humours, and a crude tubercle in the lungs

Alexander Trallianus does not expressly mention Asthma by name, but doubtless alludes to that affection of disordered respiration when he treats of the “ signs of viscid “ humours contained in the lungs;” which, he says, must clearly flow there from the head, or some other part. He proceeds to relate a case which he considers as very wonderful and uncommon, and connected with the symptoms which distinguish that disorder of the lungs, proceeding from the irritation of viscid humours; the ejection of a real stone by expectoration. He adverts also to similar histories by Galen, in which stones, or concretions like hail, are recorded to be spit up. Instances of this kind have been sufficiently referred to in the first part of the Inquiry. Viscid serum, and such extraneous

substances, were the only recorded causes of Asthma at this period of medical observation: nor is any alteration to be expected during the interval of many centuries.

At length the Arabian adopted the pathology of the Greek physicians, with some addition, but little or no rejection of their facts: in Asthma their doctrine was accepted without dispute; and the remedies directed were to incite, dry up, expectorate, divert, and purge off serous humour in the lungs. Avicenna gives the caution of not using the most powerful diuretics, lest the thinner fluid should be discharged, and the thick remain behind.

This practical direction resulted from the deference which the Arabian physician paid to the doctrines which he received from Greece. Pituita was supposed to take a consistence according to the situation in which it was included after it had descended from the head. At first it was watery and thin; then mucous as it was thickened by warmth; when the mucous distillation was shut up in a cold part of the body, it assumed tenacity, and became vitreous; and in this state would create excessive pain if transferred to a hot situation: it

was lastly gypseous, or stony, when included in the lungs, kidneys, or joints; because here the humour being resolved, and the thinner parts carried off, the thickest hardened into calculous substance.

When these obstructions were the only causes clearly assigned by the ancient writers for the production of Asthma, Willis might justly remark, that they were not aware of a purely convulsive affection in contemplating the general character of that disease. Morgagni,* by his criticism, has not invalidated the assertion of Willis; for though the nerves may be sometimes particularly affected in the opinion of those authors, the impression which they receive is from defluxion of serum, pituitous matter, or its supposed origin, the vapours from the lower viscera. It is a very strong proof of the infrequency of Asthma, without manifest irritation from such causes, when the subject of more obscure causes is matter of debate.

The Arabian writers were themselves copied with servile dependence till the sixteenth, and even the seventeenth century, when the diffusion of anatomical knowledge,

* Liber II. Epist. XV.

and a zeal for experiment, may be supposed to have excited more clear discernment of causes and effects, and more just reasoning on their relation. We shall therefore select some examples of the doctrines on Asthma at those periods; but shall listen with most attention to Willis, who has given so remarkable a tone to the teachers who followed him in treating of this disease, that his authority may be traced through the opinions of Hoffman, Floyer, and Cullen; though it will appear that these celebrated men had a very imperfect, if not erroneous comprehension of his principles and meaning.

Jodocus Lommius* gives the signs of this disease under the term Anhelatio. He attributes it to concreted phlegm, and even stones in the lungs; and informs us, that those suffer most who are most troubled with defluxions and coughs; and if during the prevalence of the symptoms a new defluxion comes on, the patient is commonly destroyed. In speaking of a crude tubercle, he says, that the signs are like those in Asthma, except-

* Observat. Medicinal. Liber Secundus, P. 110, necnon pp. 125 & seq.

ing that no preceding defluxion is remarked, and respiration is performed without wheezing.

Sennertus* delivers a pathology which entirely depends on the extraneous and evident irritation of substances described in the first part of this Inquiry; or, secondly, on the serous humour which the observation of preceding writers, and the experience of his own age, had concurred to establish as the predominant symptom of Asthma. He informs us, that the proximate cause of Asthma is the straitening of the bronchial tubes from compression or obstruction of humours often thick and viscid; sometimes thin and serous, but copious in quantity.

The hereditary disposition to Asthma is also stated to consist in a certain laxity and weakness of the lungs, by which the organ is frequently more liable to receive a flux of humours, and to permit their accumulation. In the prognostic, he says, other symptoms besides the pulse and respiration must be attended to; for these may deceive the physician. Some patients die suddenly by suffocation, with a good pulse; whilst others.

* Tom. II. Lib. II. Part. III. Cap. 2.

Having a bad pulsation, are quickly restored by the dispersion of flatus, or *the discharge of serous humour*. But though he does not oppose the common theory, that this disease arises from cold humours descending from the head, he is of opinion, that the flux proceeds still oftener from the crude serum about the liver, and in the venous system being carried into the lungs.

According to Riverius* respiration is disordered by causes sympathetic and idiopathic.

Amongst the idiopathic is a serous or pituitous humour effused in the parenchyma of the lungs; so we must construe “*spongiosæ pulmonis substantiæ imbibitur.*”

Though the generic application of the term Asthma takes in all difficulties of breathing, its more particular meaning points out that disorder of respiration which arises from the infarction and obstruction of the bronchia, in its proper character, without fever, though sometimes fever may attend. The divisions of Asthma are into Dyspnœa, Asthma, and Orthopnœa. The Dyspnœa is inferior in degree to Asthma and Orthopnœa, being

* Vide Præceos Medicæ, Liber VII. Caput 1.

the effect of less quantity of matter obstructing the lungs; it is therefore without wheezing. Asthma is then described with this attendant symptom: for, says the writer, in Asthma, properly so called, the bronchia are filled with a pituitous humour, which, meeting the air in respiration, occasions the sound called wheezing. Orthopnœa is the extreme degree of this disorder of respiration.

The humour producing Asthma is generally pituitous, and flows from the head into the lungs; sometimes crude serum is translated “a venoso genere per arteriam venosam in pulmonem.” If this serum flows to the bronchial pipes, a true Asthma with wheezing is produced; but if it stops in the substance of the lungs, and in the small arteries, a spurious Asthma, without wheezing, is the consequence. This latter species of Asthma, says Riverius, is unknown to physicians in general, who will acknowledge no other cause of the disease except a defluxion from the head. He then points out how it is to be distinguished: it is not a form of that convulsive Asthma now under consideration, but symptomatic of obstructions of the liver and lower viscera, and ends in dropsy.

In these examples we may, however, see, that, in this period of medicine, serum was a permanent feature in the character of Asthma; that, when a practical observer reflected on the various causes, he deviated from the authority of former experience, without deserting that material indication; and that, if a pituitous flux from the head was occasionally superseded, a flow of serum from the pulmonary vessels took its place in the prevailing doctrines.

Cases of Asthma, so purely convulsive as to be independent of the influence of serous effluxion, must have been extremely rare; for they are not acknowledged as a species, nor ever clearly excepted from the general account,

Morgagni,* commenting on the doctrines relative to the cause of Asthma, censures physicians for so generally adopting a theory of nervous convulsions, which, after the publications of Dr. Willis, they were seduced to espouse from the facility and convenience with which a pathology could be maintained by their application. These principles were so much abused in the opinion of that anatomist, as to be referred to when organic

* De Causis et Sedibus. Lib. II. Epist. XV.

derangements were not absent; and particularly in disorders of respiration convulsions were as much accused at that time, as the vapours had formerly been by the ancient physicians. The criticism applies with great justice to many systematics, who have seized upon the authority of Willis, and greatly misapplied his principles. They have taken up the extensive influence of nervous communication, but they have neglected to consider the force of vitious and abundant serum in exciting Spasmodic Asthma. For, whether this condition supports a connection with spasm in the manner assigned by Willis, or is merely a habit of distinct consideration, there can be little doubt of the existence of an excess of fluid, as he would faithfully record a fact which the senses of ordinary observers could enable them to establish or confute.

This will appear more convincingly if we examine some passages of the writings of that author, which shall be exhibited in his own words.

In speaking of Cough and Asthma, these affections, he observes, are said to be sometimes purely spasmodic, without an organic fault in the lungs, but more frequently to arise from a spasmodic cause, supervening on

the pulmonary affection, “oftenſo ad hunc
 “modum quod tuſſis neque ſolummodo,
 “neque ſemper pulmonum vitio, ſed inter-
 “dum a cauſa ſpaſmodica ſolitaria, ſæpius
 “tamen ab hac, *affectioni pneumonicæ* ſuper-
 “inducta, oriatur; etiam de pathemate
 “quodam alio thoracico, ſcilicet *Aſthmate*,
 “fere idem pronuntiare non dubitemus.”*

But though he may admit the pathology of a purely ſpaſmodic affection in ſome few caſes, a reference to his works will convince an inquirer of his acknowledgment and ſupport of irritation from ſerous humors in general inſtances. The procatarxis is in his language a redundance of theſe humors in the maſs of blood, and in the whole body:†
 “cujus materiæ portio quædam, arteriarum
 “oſculis in pulmones exudans, tuſſim ordi-
 “nariam creat; poſtea cum ſeroſa colluvies
 “adhuc in ſanguine exuberans, et particulis
 “ſpaſmodicis reſerta, etiam intra caput agge-
 “reretur, eadem nervos pneumonicos ſubiens,
 “tuſſim ſimplicem, in convulſivam adauget.”
 This account of purely ſpaſmodic Cough or Aſthma, ſeems to give as much importance to material irritation as if he had entirely declined the conſideration of any other cauſe,

* Willis Opera. Tomus Prior de Morbis Convulſivis, Caput xii.

† Ibid Cap. xii. p. 137.

for the predisposition consists in a condition of the blood leading to watery effusion in the lungs, and the next source of convulsive motions is this serous colluvies, filled with spasmodic particles, which change simple contractions into convulsive, by falling upon the pneumonic nerves.

The serous colluvies is every where referred to, and may be sufficient evidence of the author's opinion, because hydropic effusions have been seen. As to the *spasmodic particles*, I can only judge of such interference by the effects of the matter supposed to convey them. The hypothesis will not be tolerated at the present day, but it is not less defensible than many other theories, and the language is perhaps more in fault than the conception. It is not offering great violence to the sentiments of the writer if we construe his doctrine thus: "an hydropic habit prevails in Asthma, the watery condition of the blood, and the atony of the arterial vessels precede the serous effusion into the air cavities of the lungs. In this mass of extravasated fluid, an *irritation* is found, which excites the convulsive actions of the muscles, intended to discharge it from the organ."

“ Nihil enim usitatus, quam tussi in-
 “ veterata, aliave mala pulmonum diathesi
 “ laborantes, demum *hydrope*, aut *scorbuto* ac-
 “ cedente, *Asthmaticos* fieri: nempe cum fan-
 “ guis, longe impurior factus, sæculentias
 “ *serosas* etiam in capite deponit, hæ nervos
 “ *pneumonicos* utpote debiliores, et juxta
 “ extremitates suas crebro irritatos, promptius
 “ et quidem facilius quam alios subeunt, in-
 “ que iis *dyspnææ spasmodicæ* materiem con-
 “ gerunt.”*

The Dropsy, the Asthma, and the Scurvy, are here united in the explanation of the convulsive disorder.

In proceeding, the language is still less ambiguous, because he directly and plainly terms that form of Asthma, *purely convulsive*, which arises from the serous colluvies of the habit, “ porro interdum observavi, graves
 “ *Asthmatis paroxysmos*, sine quavis notabili
 “ pulmonum labe accidisse; revera ut puta-
 “ verim, hunc *morbum* aliquando esse *mere*
 “ *convulsivum*, ejusque insultus solummodo
 “ excitari quoniam *serosa colluvies*, particulis
 “ explosivis referta, *nervos*, pulmonum dia-
 “ stolen perficientes, subiens, spiritibus
 “ ibidem scatentibus accrevit.†

* Willis de Morb. Convulsive, Caput xii. p. 138.

† Ibid. p. 138.

Willis, it thus appears, had not in his contemplation a species of Asthma entirely divested of the character which has been lately only given to the humoral Asthma. Whilst his authority has been followed by the nosologists and teachers of the modern schools of medicine, his meanings have been perverted, or his context not studied. It is only by reference to his doctrine of Convulsive Cough and Asthma in the twelfth chapter, *de Morbis Convulsivis*, and by considering his opinions, “*de Respirationis Læsæ Speciebus*,” that his treatise “*de Asthmate*,” which follows, can be properly understood. In the latter he alludes to his general theory of the cause of convulsions, and applying it in Asthma, we are to follow his data when we accept his conclusions.*

In his chapter† “*de expiratione læsa*,” he places cough as the principal effort of that action, and says the causes inducing it are *irritating*; in more fully describing the situation of irritating materials, we are informed that these are sometimes deposited in the ultimate vesiculæ of the trachea, and are not expelled without vehement labour frequently repeated.

* Vide Opera, Tom. Posterior de Asthmate, p. 125.

† Caput. IV.

This cause of cough elucidates the nature of the cause of Asthma, and as will be explained hereafter, distinguishes the irritation which produces that disease. It is owing to the deep seat of the mucus, and its filling up the air cavities, that the action of expiration is generally impeded, and that the mode of expiration denominated cough, is, in the beginning of the disease, small, interrupted and painful.

If any doubts can remain as to the sentiments of this original author, it surely must be removed by more particularly adverting to his frequent experience of the hydropic effusions which precede, accompany, or follow the Asthma. I have plainly discovered, says he, by dissection, that the cause of *Convulsive Asthma* is sometimes seated in the head at the origin of the nerves; some patients becoming Asthmatic, were under the necessity of keeping an erect posture of the head. If they reclined there was imminent danger of death.—After the head was opened, “feri acris colluvies ingens intra cerebri cavitates aggeretur.”* He concludes his observations on the disease, by the case of a nobleman, who had for some winters been subject to a moderate cough and expectoration. At the close of autumn he was at length seized with Asthma.—

* Willis de Asthmate, Tom. 2. Cap. XII. p. 126.

After an attentive course of treatment, in which evacuants had perhaps too great a place, the physician pursues his history thus: “ licet infultus Asthmatici parum aut minime eum
 “ uti prius noctu incesferent, tamen ob pulmones plurimum infarctos, et humorem ferofum in pedes delapsum, citatius incedere aut
 “ loca acclivia ascendere, sine gravi dyspnœa, et præfocationis periculo nequibat; jamque
 “ (dum hæc scribo) deinceps non tam *Asthma*, aut *Phthifis*, quam *Hydrops* timetur.”

The remarks which follow the case are very important, and clearly correspond with the pathology which is exhibited in his doctrine of convulsive motions; they undeniably support the presence of serous accumulation, and deduce the muscular convulsions from the influence of such effusion. I shall therefore, take my leave of this writer, and finish a cursory review of his opinions, by presenting the passage which closes his chapter “ de Asthmate.” Deprecating however, in favour of estimable observation and experience of facts, too nice a trial of the just application of words which are evidently framed in compliance with the erroneous opinions of the day, and more particularly leaning to the hypothesis of Sylvius on the crasis, the effervescences, the faults, &c. of the blood.—“ Casus hujus Ætiologia ex supra dictis satis liquet, viz. Asth-

“ matis hujus procatarxis una in pulmone valde
 “ obstrueto versabatur, proinde ut cum sanguis
 “ effervescens præcordia impetuosius pertran-
 “ saret, aër ad ipsum eventilandum requisitus
 “ non satis uberi copia admitti potuerit; quare
 “ ad hunc defectum supplendum necesse fuit
 “ pulmones, eorumque *organa motiva, in nix-*
 “ *us crebriores et vehementiores incitari.* Pos-
 “ tea dein hinc accessit fibrarum pectoris mo-
 “ tricium *diathesis spasmodica*: quippe *mate-*
 “ *ries heterogenea* una cum succo nerveo in
 “ eas partes descendens, et ad plenitudinem
 “ aggesta, primo dolorem, et postea in organis
 “ pneumonicis, spasmos atroces, et periodicos
 “ excitavit: jamque diathesi hac posteriori
 “ quamvis cessante (quia scil. materies elasti-
 “ ca et spasmodica a *serosa illuvie* obtunditur,
 “ aut obruitur) adhuc tamen procatarxis altera
 “ manet, alterumque comitem, viz. *Cacodæmo-*
 “ *nem seipso deteriorem, sc. hydropem consci-*
 “ *vit.*” *

Willis first established the doctrine of con-
 vulsive motions in Asthma, and succeeding
 writers have generally contented themselves
 with adopting his theory. “ It is astonishing,”
 says Morgagni, “ that Willis should have been
 “ the first who observed the nature of symp-

* Willis, Opera, de Asthmate, ad finem.

“toms, which we have universally, since his
“time, acknowledged to exist in Asthma.”*

It is, indeed, truly remarkable, that physiologists should have neglected to notice, that the contraction of any muscle performed with greater frequency or more energy than is common in health, should assume the type of convulsion or spasm; for convulsion is nothing but a too strong contraction of the muscle or fibre, and respiration being only exercised by contraction of muscles; if that contraction is stronger than the purposes of ordinary health demand, it may be justly said to have become convulsive or spasmodic.

But if surprise is excited by the nature of the contractions in Asthma not having been ascertained before the time of Willis, still greater wonder may be expressed that subsequent authors should have been so much occupied in contemplating the new actions, as to forget the evidence of the state of the habit in which they were said to take place, and which was by Willis esteemed so prominent and conspicuous, as to be the very cause exciting the morbid motions which he described.

It would be next in order to consider the opinions of Floyer, Hoffman, and Cullen, but having arrived at the basis of their superstruc-

* Morgagni. Lib. II. Epist. 15, 5.

ture, or rather at the very building which they protect, though they have neglected to preserve its integrity, I shall previously take a view of the evidence afforded by anatomical observation.

SECT. VII.

Anatomical evidence of serous effusion in the vesiculæ of the lungs of Asthmatics.—Effusion in complicated cases very frequent; in uncomplicated cases seldom inquired for, but occasionally discovered.—A series of Anatomical Observations applying to complicated and uncomplicated Convulsive Asthma.—The Suffocative Catarrh considered.—Evidence in Living Subjects of excessive Effusion in the Vesiculæ of the Lungs, as palpable as from Dissection.—This Condition supported by the Description of Asthma by Cælius Aurelianus.—Physiological Considerations on the Entrance of Serum into the Air Cavities of the Lungs.—The Experiment of Dr. Goodwin.—The Authority of Dr. Hales.

ASTHMA is very seldom fatal in its uncomplicated form, and therefore few opportunities have occurred to examine the state of the lungs. I am not acquainted with any observations of practitioners discovering the result of anatomical inquiry after the cause of merely Spasmodic Asthma. For this *Morbus Maxime Terribilis*, as it is called by Willis, may be carried on to old

age, if supervening diseases do not cut short the patient, or disturb the operations of nature by which recovery from the paroxysm is accomplished. When the progress of the disorder is not favorable, Dropfy or Apoplexy are the diseases which are commonly known to alter its character and destroy the patient.

Many instances may be found of effusion in the vesiculæ of the lungs from these complicated causes; but as an organic alteration of structure has been frequently discovered in the thorax, preceded by symptoms which greatly excited medical curiosity, dissection has still more generally exposed effusions in the sacs of the pleura and in the pericardium. These are so often consequences of inflammation, polypi in the large vessels, or ossifications of their coats, that opportunities must have occurred of anatomical evidence of the fact as frequently as the profession could require.

The termination of uncomplicated spasmodic Asthma is, on the contrary, not likely to be the object of examination: for, when the pulse has been equal, and sudden death has not closed the scene, the inquiry into causes is not urged with eagerness, nor pursued with anxiety. But it will be acknowledged, that such a close of the disease is not to be expected.

An acute disorder may come upon the Asthmatic, and the contents of the thorax may be found marked with the consequences of inflammation: Dropsy may generally pervade the habit, and effusion will be found in the cavity of the breast, or in the cellular substance, as well as the vesicles of the lungs; or it may only be found in the sacs of the pleura, and the cells of the lungs may have been relieved by the operation of natural absorption; for whilst that power is alive, it may be expected to use its energies in defence of the last reservoir of vital stimulus.

It was not always a subject of wonder, that the lungs should be found filled with serous fluid; we therefore are not to be extremely surprised, that the presence of this matter should be neglected amongst the probable causes of Asthma. Though Morgagni frequently discovered this condition of the air vesicles after death, when the patients had laboured under disordered respiration, he generally contents himself with recording the fact; and dwells with more attention on the alterations of organic structure, which, in these instances of complicated disease, he had an opportunity of remarking. The effusions into the cavities of the chest and

the pericardium are more carefully noticed than effusions in the vesiculæ and bronchia; the latter could not, in cases commonly occurring, be productive of death; the former are, indisputably, frequent causes of fatal issue, though their preceding symptoms are less distressing than the paroxysm of convulsive Asthma.

We are therefore not to expect such a series of facts, nor so copious a history of evidence of morbid effusion in the air cavities of the lungs in cases of simple, uncomplicated, Spasmodic Asthma, as in cases where that might be the attendant disorder, but where life was terminated by one of more decisive violence.

But as there is some light to be obtained from examination of these complicated cases, we shall present a few of the more prominent instances; not doubting, at the same time, of a very accurate search being answered by more extensive satisfaction.

I shall likewise be determined by the account of symptoms, to claim for the advantage of our inquiry cases which may be classed under other heads, but which I believe to belong to convulsive respiration,

OBSERVATION I.

MORGAGNI's observation of morbid bodies had induced him to give a spacious opinion, which may apply very closely to our assigned cause of Asthma. He says, that concretions in the bronchial tubes, and indurations of their glandules, very often arose from viscid humours, or pus remaining too long in these passages, or the air cells at their extremities:* this is informing us in other words, that after fluid matter has been present to occasion Periodic Asthma, it is capable of becoming the cause of Continued Asthma; a species which has been treated in the first part of the Inquiry, where may be found much authority in support of the reasonableness of his suggestion.

This author presents us also with some detached facts, which are to be classed as complicated cases of Asthma.

OBS. II.

The lungs of an Asthmatic subject, described Epist. XXII. Art. 4. were found in

* De Causis et Sedibus. Lib. II. Epist. XV. Art. 19.

the following state :— The right lobe was found, but in the lower part very red ; the left was universally pale, contracted, and hard, and contained sanious matter.

OBS. III.

Article 34. Epist. XVIII. A history of the dissection of a patient, whose disease was denominated Convulsive Asthma.

The heart was diseased, and the lungs were filled with a frothy liquor ; but there was no effusion in the cavity of the chest.

OBS. IV.

Article 30. Epist. XXI. A disease of the breast is reported, which was accompanied with laborious respiration. The air cavities of the lungs were found to be filled with frothy serum.

OBS. V.

In the same Epistle, Article 33, a similar discovery is recorded : but in this patient, who was a soldier, the disorder of respiration had been attended with fever, as well as uneasiness and pain in the chest.

OBS. VI.

Morgagni, as well as other anatomists, records many instances of serous effusion, after pneumonic inflammation. This consequence of such a state of the lungs will be readily accepted without dispute.

Dr. Hamilton* has applied the observations of Morgagni to a very useful purpose; and treating of pneumonia gives several cases, which, on the authority of the latter, confirm the fact of effusion from pulmonary inflammation. See Cases X. XIII. XVIII. XIX. XXIV. XXXII. XXXVIII.

OBS. VII.

Fabritius Hildanus opened a subject, who became asthmatic after a concussion of the brain. The disease ended fatally from the occurrence of a catarrh falling on his lungs. The lungs were found every where filled with pituitous and viscid fluid. See Cent. I. Obs. XI.

* Observat. on the seats and causes of diseases, with Morgagni's dissections. Vol. I.

OBS. VIII.

Hollerius, Prax. Lib. I. Cap. 25. in scho-
liis, has informed us of an Asthmatic, in
whose lungs, after death, the same pituitous
fluid was found as in the preceding case.

OBS. IX.

A woman of forty years of age is stated to
have died of Asthma; but she had also a
stone in the kidney. A great quantity of
frothy water was found in the cells and bron-
chia of the lungs.

This anatomical history is given us by
Frederic Ruyfch. See his works, Tom. I.
Obs. LVI.

OBS. X.

For another instance of this morbid ap-
pearance in the lungs of a subject, who had
suffered the Asthma, see Riverius, Observat.
LX. Centur. I.

OBS. XI.

An Asthmatic died, and his lungs were
found filled on both sides with serum; but

there were likewise adhesions to the diaphragm and pleura. The pylorus was diseased, and also the duodenum and pancreas; the pineal gland was full of white concretions.

This dissection is communicated by H. Ridley, in his *Observations de Asthmate et Hydrophobia*. They are given in German with Floyer's treatise, by Joanne Christian Frederic Scherf.

OBS. XII.

In the serous apoplexy the condition of the habit is exhibited very commonly by effusion in the lungs, as well as the brain; dissection proved this in one instance which I treated. When the lungs were cut open, the bronchia and vesiculæ were found to be filled with frothy serum; and the ventricles of the brain contained a serous fluid in unusual quantity. The stertorous breathing in this patient was very remarkable, and seemed not less to partake of wheezing, as the sound is termed in Asthmatics, than of the snoring which belongs to apoplexy.

OBS. XIII.

Morgagni, in treating of serous apoplexy and lethargic affections, gives some dissec-

tions which shew this morbid condition of
serous effusion in the lungs, as well as the
brain. See Article 16, 24, 26, of Epist. IV.
and Art. 12. of Epist. VI.

OBS. XIV.

The extreme case of serum in the vesiculæ
must be when accidental or concurring dis-
eases have so weakened the patient, that the
irritation of the matter cannot excite the
powers of the habit to eject the inconve-
nience; when sensibility or irritability is at
so low a point, suffocation may be appre-
hended, but it has never occurred, except
from the prevalence of such occasional causes
in convulsive Asthma. There are instances
of suffocation when the debility of the sub-
ject has been intense; and others have been
often recorded, where, from a similar condi-
tion, the danger of this event was imminent
and great.

Morgagni* gives the history of a maiden
subject, who died with a fluid running out
of her mouth. She had been invaded by
disease from taking cold at the time of men-

* Epist. XXI. 29.

struation; and difficulty of breathing was a reigning symptom. The abdominal viscera and uterus were in a very morbid state; but the lungs were distended with a *frothy serum*. The dissection does not prove that she died from the state of the lungs only, but that an effusion had taken place in that organ; and it is to be deduced, that the natural effort of respiration was unequal to contend with that particular affection, for the fluid issued from her mouth agreeably to the feature which Cælius Aurelianus has given in his description of Asthma; and in this passive submission of the system to the violence and extent of the disease, she expired. An instance similar to this, as far as regards the affection of the lungs, will be seen in a patient, who survived the discharge, and whose case is an acknowledged Asthma.

But it would comprehend too extensive an inquiry if I was to proceed without a limit in the examination of cases of Asthma, complicated with abdominal diseases, and organic derangements of the vessels of the thorax, in which the particular condition of the vesiculæ, to which I attribute the convulsive respiration of uncomplicated Asthma, is to be found by anatomical industry.

I shall, therefore, confine myself to some select cases, which, whatever name may have been imposed upon them, are, in my opinion, evidently instances of Spasmodic Asthma; but without affording subject of theoretical debate, by a connection with chronic diseases of the viscera, except such as Asthma may be allowed to produce.

OBS. XV.

“ In opening into the chest,” says Dr. Baillie,* “ it is not unusual to find that the
“ lungs do not collapse, but that they fill
“ up the cavity completely on each side of
“ the heart. When examined, their cells
“ appear full of air, so that there is seen
“ upon the surface a prodigious number of
“ small white vesicles; the branches of the
“ trachea are at the same time much filled
“ with a mucous fluid. This is not un-
“ commonly the case in persons who have
“ laboured for some considerable time with
“ difficulty of breathing, but without any
“ symptoms of inflammation; such persons
“ would appear to die from want of a sup-
“ ply of atmospheric air sufficient to pro-

* Morbid Anatomy, p. 50.

“duce the proper change in the blood,
“which is necessary for its useful circula-
“tion through the body.”

OBS. XVI.

A mason was admitted an out-patient of the Leicester Infirmary in the year 1786. He had been affected with asthmatic complaints for several years, and traced the origin of his disorder to a severe cold, after having been confined with the rheumatism. The habit of this man was thin, and his temperament inclined to sanguine; his paroxysms of the Asthma had been most severe in the winter, but had frequently attacked him in the milder seasons. He had pursued his labour without much consideration of his disease; and generally allowed himself but one day of rest for the paroxysm to abate. At the time of his admission he had been alarmed by the opinion of his apothecary, that he had an aneurism of the aorta, or a polypus in the ventricles of the heart. I perceived that this opinion was founded on the pulsations at his wrist, which were frequently indistinct, and at other times intermitted; occasionally I remarked the beat of the artery to be large and throbbing.

His feet were œdematous, his countenance pale, his breath always short; he had some cough, but he only expectorated after the paroxysms. The accessions of his disorder preserved their character: he had severe approaches in the evening; and if he was free some weeks from strong symptoms, the invasion of the fit was truly regular in the manner of Spasmodic Asthma. I did not attribute the irregular pulse to a disease of the heart or large vessels; but directed some emetics and absorbents for the stomach: after the use of these the pulse was more regular. He then took expectorating and diuretic medicines, with great relief; and after some weeks was at least so well as to abandon his physician. His pulse had resumed its former standard, his appetite was mended, his flatulence gone, expectoration much more free, urine natural, respiration not much disturbed by exercise, and the paroxysms lost. At the commencement of the succeeding winter I was desired to call upon the same man, who having been greatly exposed to wet and cold was laid up in his own dwelling. I was requested to receive him into the Infirmary; but it appeared improper, because his difficulty of breathing was too considerable to bear

the air of an hospital ; and the symptoms were so critical as to leave little expectation of his living through the night. The application of blisters to the breast and legs seemed to encourage hope, for his pulse was raised after they began to draw. A mixture of oxy-mel scillæ, and ipecac. wine, puked him once with advantage ; after four hours it was repeated, but it acted only upon the bowels ; several loose stools were discharged, and he sunk under his weakness, having had a regular accession of the paroxysm two nights before, which had not been succeeded by expectoration. I was permitted to open the body, an object which had induced me to frequent the patient with some assiduity after I perceived the improbability of his surviving the state of weakness and laborious respiration in which I found him.

The abdominal viscera exhibited no mark of disease, the bowels were emptied of feces, and the stomach was very flaccid, and expanded in the coats ; the head contained no excess of serum, but the vessels were rather turgid ; the lungs were very heavy, and being pressed, a frothy liquor was made to issue from his mouth. The substance was then cut open, and the cells and bronchia were found full of serum, of a light colour, un-

mixed with blood ; there was no water in the pericardium, nor in the sacs of the pleura, except the usual moisture ; the heart and large vessels were natural. After the serum had been discharged by pressing the lungs, the mucus which still adhered to the coats of the vesicles appeared more frothy than the general mass, and was also of a darker colour, making the membrane in some places nearly black.

The disease described by Dr. Millar has been subject of doubt ; Cullen places it under *Cynanche Trachealis*, and considers it as the Croup. It is, however, not clear, that Spasmodic Asthma would be a different disease from that which Dr. Millar observed, if it attacked infancy only ; at all events it was a disorder of respiration, and admitted of nosological distinction as far only as it was accompanied with fever and inflammation. In the extreme irritability of an infant subject, inflammation may occur in the course of symptoms, arising from causes obstructing the air vesicles, when in adults these causes may induce asthmatic paroxysms, without exciting fever, or so much sensation as to inflame the organ ; for these reasons it may be

proper not to omit the observations of Dr. Millar on the morbid appearance of two infant subjects.*

OBS. XVII.

A child died in the first stage. The external parts were soft and œdematous; the lungs, and all the other bowels, were sound; the stomach and intestines much inflated with rarefied air, but contained no fæces.

In this instance there is no difficulty in concluding that the child was carried off by a convulsion, in so early a period as to prevent the disorder from taking the character of a pulmonary disease. The great distention of the stomach permits the inference of indigestion having been a previous complaint, and that the first passages were very feeble; this condition might suddenly induce difficulty of breathing, by preventing the descent of the diaphragm; and, in the irritability of infancy, the consequences which happened are not uncommon. The absence of inflammatory appearances in this dissection will not allow the supposition of the Croup having destroyed the child.

* Vide Dr. Millar on the Asthma and Hooping Cough.

OBS. XVIII.

A child died in the second stage described by Dr. Millar. She had laboured under violent symptoms of the Asthma till the tenth day.

The vessels of the pleura, on the surface of the lungs, and of the trachea, were turgid, and seemed obstructed; the parts had a livid appearance, resembling that which is observed when an inflammation terminates in a gangrene; the bronchial vessels were filled with a white, tough, gelatinous substance.

The *Suffocative Catarrh* is described by Schneider as follows: — “ It is allied to the
“ apoplexy and syncope, but is distinct from
“ those affections: the diagnostic signs are,
“ a weight and pain of the breast, a difficulty of respiration, an interrupted voice,
“ danger of suffocation, anxiety, sometimes
“ a cough, a slow pulse; the membrane
“ lining the nose and mouth before and behind discharges a flux of serum, with
“ which the mouth is occasionally filled.”*

If wheezing had been a symptom described by Schneider, and the inflammation of the mucous membrane of the nose and mouth

* Schneiderus de Catarrh. L. V. C. 4.

had been omitted, the character given of Suffocative Catarrh would not have been improperly applied to Spasmodic Asthma: there is, doubtless, a distinction between the diseases; but there may be subjects affected with this Catarrh in whom the line of separation will be lost.

If the tone of the capillary exhalents of the lungs be reduced to a low point, and if this condition occurs in a habit disposed by custom to a ready association of muscular contractions, and particularly of morbid contractions of the respiratory muscles, Asthma will be the disease occasioned by the defluxion, which in other subjects might be called Catarrh, or, according to Schneider, Suffocative Catarrh.

OBS. XIX.

The history of the Catarrh which prevailed in Italy in the year 1730,* gives a specimen of Asthma terminating the more acute disease. The cardinal Johannes Franciscus Barbadicus yielded to his disorder, which

* The epidemic catarrh, or influenza, raged on the Continent, 1580, 1675. See Bergerus de Circul. Lymphæ. C. II. §. 7. Forestus. Lib. VI. Obs. 3.

Morgagni calls a Suffocative Catarrh, and which was probably a species of that epidemic which is now called influenza by the admirers of novelty: whatever was the affection under which the cardinal laboured, its progress was marked by so considerable a disorder of respiration as to merit the name of Asthma, and when expectoration could be no longer exercised, the patient died from suffocation. His lungs were found full of serous fluid; but there was no adhesion, or other mark of inflammation. His physician's words are as follow: — “*Graves erant ipsi pulmones, sed a catarrhali, quam continerant, materia, multa passim e bronchiis, quacunque incideres, erumpente. Certe eorum omnis substantia flaccida, non modo non densa, aut compacta reperta est.*” The subject was gibbous, and seventy-two years of age, and as he had been frequently affected with defluxions on the lungs, the termination of the disorder could excite no surprise, any more than the morbid appearances on dissection. Had this plentiful effusion of mucus, or serum, invaded the pulmonary function of a younger man, whose irritability had been less exhausted by age, the actions of the respiratory muscles, and of

the absorbing vessels, would have been roused to energy equal to the task of delivering the organ from the oppressive offence; and the patient would probably have recovered, to fall under the symptoms at a future attack.

Morgagni relies much on the predisposing cause of a gibbous spine, which, he says, represented the letter S; and he adverts to the case of a similar subject of high rank, whose spine had the same form, and whose lungs were filled with a fluid of the same kind. Those who saw the dissection, says Morgagni, very rightly adopted the opinion of Heucherus:—"Sigillatim hi catarrho suffocati censendi sunt, quibus serum, seu lymphæ sanguinis, quacunque de causa, vitiosa, copiosius respirationis organa occupat, et in bronchiis vesiculisque pulmonum pertinacissime restagnat."

The Suffocative Catarrh was considered by Morgagni as the disease of these subjects: the former, he particularly asserts, was not affected before he died with any symptom of peripneumonic fever, nor were any signs to be discovered in the lungs of such an affection, after death. This distinguished the case from that described by Jo. Seb. Albrecht-

tus,* which was called suffocative, and was fatal to the patient; but in this case a peripneumonic fever supervened upon the epidemic affection. We may safely say, that the reverend Cardinal expired under a paroxysm of Asthma, in which the convulsive motions were as strong as the irritability of the patient would admit.†

OBS. XX.

An ecclesiastic advanced in life, with a short neck, and fat, had been long out of health: he led a sedentary life, and was cachectic. (*Cocochymiam valde scorbuticam contraxerat.*) He was so affected with difficult and laborious respiration, and heaviness and torpor of the head, that he was capable of no exercise, except the going to chapel and returning every day. He was seized in the execution of his duty with insensibility, and fell on the ground; he was taken up, and put into a warm bed. When the physicians arrived they found him with-

* Vide Commerc. Litter. A. 1743.

† See Morgagni, Epist. XIII.

out pulse, respiration, or sense, and his body cold and stiff; he was therefore unaffected by the medicines which were applied. The succeeding day the body was opened; and there was no doubt of a disease so suddenly fatal having left vestiges in the brain, where the cause probably lay. The encephalon was accurately examined, but, to the surprise of all, was found in its contents. "*Morbi, licet atrocissimi ne vel umbra quædam supererat.*" Proceeding to the thorax, the heart was found perfectly firm, and entirely free from any obstruction or polypous concretion. The cause of the laborious respiration, and ultimately of the death of this patient, was at last discovered in the substance of the lungs, this organ being discoloured, and its vesicular cavities entirely filled with a *frothy serum*.*

Proofs of serous effusion in the vesiculæ of the lungs may, I have little doubt, be found in much greater extent, by careful examination of morbid bodies, and more particularly in subjects who had been affected with disordered respiration. I have been chiefly desirous of giving evidence to elucidate the cause of the *uncomplicated* Spasmodic Asthma. Anatomical observation has furnished

* Boneti Sepulchret. Anatom. Lib. I. Sect. II. Obs. 57.

some instruction in this inquiry, and still more is to be obtained from a consideration of some prominent appearances in the paroxysm of Convulsive Asthma, when, fortunately, the patients did not sink under the extreme urgency of their affections: these appearances have not commonly occurred; and still more singular is a recovery after they have marked the debility of the habit, and extreme severity of the case.

In the fourth part of Considerations on the Medicinal Powers of Factitious Airs, by Dr. Beddoes and Mr. Watt, we have a case by Mr. Baynton,* which very clearly illustrates this pathology, and shews even more than a dissection could exhibit of the genuine cause of Convulsive Asthma: it is justly considered by that practitioner, and by Dr. Beddoes, as an instructive and important history. After a train of symptoms, which frequently precede Spasmodic Asthma, a Female Patient was seized with a complaint that very much resembled the paroxysm of that disease; it was, however, more violent than first attacks usually are, and its remission was attended with a very copious discharge of *frothy serum* from the bronchial tubes, which was thrown

* Vide p. 53.

up by a slight, though almost continual, cough. Remedies were pursued, with the advantage of occasional relief; but the disease resumed its former violence after the interval of sixteen months. She was attacked, after comfortable rest, at five in the morning, with Dyspnœa and Convulsive Cough; danger of suffocation was soon perceived; the senses forsook her, the face became livid, the extremities cold, and the pulsation at the wrist was lost: this state continued for two hours, during which time a very large quantity of frothy serum, tinged a little with blood, was discharged, without any visible effort, by the mouth and nostrils. “ Then some very faint and involuntary efforts to cough came on, which gradually increased, *and with every effort large quantities of the frothy serum were thrown off; perhaps the whole quantity might amount to three or four pints.* About three hours after the time of attack, the difficulty of breathing became very sensibly diminished, and her senses were observed to return.” Dr. Beddoes, in his commentary on this narrative, says, the fluid which was discharged was ascertained, by careful inquiry, to be *mucus*, and not saliva. The predisponent causes

were such as lead to Spasmodic Asthma; and Dr. Darwin considered it, as well as Dr. Beddoes, to be an extraordinary instance of that disorder. That a retrograde motion of the lymphatics should be called in to explain the symptoms, is of little consequence to our inquiry, which is only to investigate that positive condition of the air cavities of the lungs, in which arises the irritation inciting convulsive actions of the muscles of respiration.

The astonishing accumulation of serum is, in fact, the only wonder in the case; for an accumulation more moderate and controulable is to be supposed, where no excretion is observed; and we must be very inattentive indeed, in applying the powers of absorption to the disorders of the pulmonary organ, if we give to that function no importance in cases which analogy so strongly indicates to be cases of morbid exhalation, or serous effusion.

But though I attribute to the history here alluded to, marks of very fortunate evidence of the cause of the disease, and though such evidence cannot commonly be expected to be exposed to our senses, from the vigilant activity of absorbing powers exerted to prevent consequences so considerable from the

atony of the exhalent capillaries, yet the description is not solitary in the annals of medicine. An important case is to be seen in the works of Alex. Monro, sen. in which the pulse became indistinct, and slimy mucus was discharged in an unusual quantity. Œdema of the feet and legs was an attendant symptom, and the progress of the disease discovered the diathesis to be decidedly hydroptic.* Here the same mucous fluid was discharged from the lungs, but its accumulation was more gradual, and the irritability of the habit was not so deficient as in the female patient; for the expectoration answered to the exciting cause in less proportions of force.

It has appeared that the ancient writers recorded defluxions on the breast very generally in Asthma, which they attributed to a descending of serum from the head. It is to be lamented, that a false theory should implicate in its disgrace the history of symptoms which accompanied it: the ancient authors have probably for this reason been too much neglected by those, whose erudition would have sustained no injury

* Works of Alex. Monro, sen. p. 604.

by reference to their fidelity of observation.*

Cælius Aurelianus† makes this excess of mucous fluid a diagnostic symptom in the very severe cases of Asthma; and it is remarkable, that this reference to the most violent state of the disorder takes away all doubt of the serous flux belonging to that form which is called convulsive. After mentioning the common symptoms in which are included wheezing, a cough dry, and then moist, spittings thin and frothy, and afterwards more thick and viscid, he proceeds to say, “ At si gravior impetus superpositionis ‡ fuerit, ora ægrotantium li-
vescunt, et quidem excluso per nares hu-

* When I conversed with a zealous systematic, whose genius will be long remembered, though his moderation and his judgment have too little supported its reputation, on the medicinal observations of Jodocus Lommius, he assured me, that “ he had long determined not to read, because he would not be corrupted; he had discovered truth, and he would adhere to it.” But is the history of appearances to be neglected, because their assigned cause is not satisfactory to the student? The accuracy of observation and fidelity of delivery, which characterise the writings of the Greek classics in medicine, will not be excelled by modern authenticity.

† Morborum Chronicorum. Liber III. Cap. 1.

‡ Superpositionis, i. e. *Paroxysmi*, secundum Lexicon Cælianum.

“more mucilento, relevantur, atque præ-
“focationis carent metu, quod non aliter
“cedit, etiamsi per oculos lacrymarum fuerit
“fluor.”

It is not to be unobserved, that the commentator on this writer, Jo. Conradus Amman, adds the following remark: “Cum
“enim per nares id exit, avertitur humor
“in pulmonem fluxurus, et intercipitur ali-
“aque via rejectus periculo suffocationis li-
“berat.”

Here we see how very averse physicians were to allow the flux of serum in the lungs any other source than the head; though it admits of no dispute, that entrance of such humours into the trachea would be precluded by the most determined resistance of the muscles of expiration, and the shutting of the glottis: this is the effort of an animal immersed in impure air; the natural nifus to inspire good air is counteracted by the more powerful aversion from bad; and the sensation of receiving in the trachea a fluid so dense as water, in the act of drowning, excites an instinctive expiration to expel it; and though the attempt to obtain air in the lungs is again repeated, the same impulse of aversion is renewed, and very little water is

admitted, though the lungs are in a state of collapse from want of air.*

This passage of serous fluid had, however, been perfectly confuted by Schneider; and Van Helmont was not ignorant of the active opposition which would be excited in the muscles of expiration, to prevent the entrance of a drop of limpid water into the larynx. “ Si quidem, si unica aquæ gutta, incaute deglutiendo, in laryngem decidens, præfocationis metum potanti incutiat, quid non faceret tanta mucci copia quæ pelves parvo subinde spatio implet.”†

But if a single drop of water affects the larynx, and excites so much energy of resistance to its passage, the insidious entrance of serum into the vesiculæ is not productive of such acute distress. That it may be borne in these cavities without instant death, when it has taken possession, is proved by Dr. Goodwin. He poured water through an opening into the trachea of a cat: the experiment induced great difficulty of breathing, and a feeble pulse; but the animal re-

* See Mr. Colman's Dissert. on Suspended Respiration, p. 3, 143, &c.

† Ortus Medicinæ Catarrhi Deliramenta, 38.

covered, in repeated instances, from the sudden impresson, to a state of seeming ease.*

Dr. Goodwin finished his experiments on cats by destroying the animals after a few hours. It would have been more satisfactory to have heard what symptoms appeared in a longer time ; with this view I made the following experiment, which, with some modifications, was repeated on cats. These animals are more tenacious of life than most others ; and I found that they would take a greater quantity of fluid into the lungs, without immediate suffocation, in proportion to their bulk, than the dog.

EXPERIMENT.

I confined a dog in an erect posture, and with the assistance of an ingenious friend, opened the trachea, and poured in four ounces of serum of cow's blood, warm ; the passage was then properly closed. The dog was set at liberty within the bounds of a kennel, three feet by four, and open to the air in the front ; he was affected with great difficulty of breathing, lay down panting,

* Connection of Life with Respiration, p. 17.

but suddenly arose with great emotion, and continued on his legs, with quick respiration, for some time. The distress gradually disappeared in four hours; but he refused food, and appeared to sleep. In sixteen hours he appeared to become unruly, and made violent efforts to release himself: broth and oatmeal was given him, which he at first took with eagerness; but he soon left off eating, and was as restless as ever; his respiration very laborious, his eyes suffused with water; the floor of the kennel was very wet, and I observed that he passed urine. After this state had continued till the twenty-sixth hour from the operation, with more or less Dyspnœa and anxiety, he became much more quiet: his breathing in thirty-four hours appeared to be natural; but he then began to rub his neck, and scratch the wound. It was soon perceived that a great inflammation was come upon the integuments; and from the trouble which the animal gave, and the pain he was in, I directed him to be strangled. Upon opening the lungs, there was collected one ounce and a half of fluid, which was much moreropy than the serum poured into the trachea; two ounces and a half, with any ordinary

mucus which was natural to the pulmonary cavities, had therefore been absorbed, or exhaled in the vapour of the dog's expirations.

It is probable, that if the cats had been suffered to live some hours longer after the experiments of Dr. Goodwin, the water in their air cavities would have been absorbed: the short time allowed to them had, on the contrary, increased the quantity of the fluid; an effect of the local irritation of the capillary mouths, before the increased action of the absorbents had commenced, and this conclusion is supported by the trials which I made on several cats; because in three which were not suffocated by the fluid poured down the trachea, the water was absorbed in two days, and I found that six ounces was the most they could receive. This quantity destroyed two cats, and more than this suffocated several.

It appears by the experiments of Dr. Hales, that water poured into the wind-pipe may pass through the bronchia into the pulmonary artery; but in the reverse direction the passage of this fluid is so free, as to run from the artery into the air vessels four-fifths faster.

Water run out of the artery into the wind-pipe of a hog at the rate of a pint in a mi-

mute : this effusion would proceed only from the artery. When the experiment was tried of pouring water into the pulmonary vein, it would not pass into the artery or bronchia, although the same force was used.

Serum of a hog's blood was afterwards tried, and it passed from the pulmonary artery most freely into the bronchia, but not into the veins.

In pursuing his experiments on a calf's lungs, warm water was poured into the pulmonary artery ; the lungs were dilated from a large pair of bellows ; the water flowed so freely from the capillary arteries into the vesicles, and thence into the bronchia, as to flow plentifully through the windpipe. As the tube through which the water was poured was four feet high, it was suspected that so much force had burst the thin blood vessels ; but this was not the case, for in several trials, in which the force of the water was less than one foot of height, (a force inferior to that by which the blood is thrown into the lungs from the right ventricle,) the result was the same.

But though serum passes with this facility from the arterial capillaries into the air pipes of the lungs, and doubtless with greater ease

after death than in a living subject, it was found that globules of red blood would not pass through these exhalent mouths into the vesicles, though the force of a greater perpendicular height was made use of.*

After some considerations on preceding experiments, and more particularly those which I have adduced, Dr. Hales infers, that some Asthmas may arise from the effusion into the vesicular cavities. He quotes Sir John Floyer, who entertained the theory of a “ constriction of the bronchia, an effervescence of the blood, and a separation of “ the lymphæ lactea, which stopped in the “ swelled glands of the lungs :” and our author suggests, that such effects may be occasioned by the defluxion of serum, of which he had pointed out the passage.

It is unnecessary to confute the whole of Floyer’s doctrine; and if part of it be true it is entirely hypothesis.

Dr. Hales has given a fact of more importance than a thousand speculations, and his inference from experiment may be permitted to rest within its natural limits. It would be unjust not to present his induction in his

* Hales Statical Essays, Exper. XI. &c.

own words, and with this I shall close the evidence which anatomical observation has appeared to me to present in support of a theory of material irritation in Convulsive Asthma.

“ When we see,” says this philosopher,
“ how freely the serum passed from the pulmonary artery into the cavity of the vesicles and bronchia, 'tis no wonder that so great discharges of humors are often made through the same passages, when the blood is much diluted, by being in colds furcharged with too much obstructed perspirable matter, or otherwise disordered: hence also some Asthmas have their origin.”*

* Statical Essays, Vol. II. p. 88:

 SECT. VIII.

Floyer, Hoffman, and Cullen, on Asthma.—Remarks on Hoffman.—Description of the disease by Aretæus.—The capillary exhalents of the lungs unlike convoluted glands.—The use and indication of Convulsive Respiration.—The convulsions may remain after the irritation is removed.—The effect of frequent recurrence of Spasm discovered by analogy of irritation situated in other organs.—Effect of irritation applied to different parts of the pulmonary system.—Dr. Cullen's proximate cause considered.—Objections to his doctrine.—Spasm must alternate with relaxation.—Dissection gives no support to the theory of Cullen.—The paroxysm in the act of dying.—Relief from discharge of mucus.—The cause of wheezing.—Sir J. Floyer, evidence against himself.—The straitness of the breast, and anxiety.—A person recovered from drowning presents an explanation of wheezing in Asthma.

THE writers of authority, who succeeded Willis, have involved themselves in the obscurity of their conjectural doctrines. If we

are to believe these pathologists, the nerves have been implanted in the animal system, to remind man of his misfortunes, and to betray the œconomy of life into perpetual derangement, and torments scarcely to be endured. The Convulsive Asthma is not marked in their descriptions by any symptoms so signal as the *invisible* constrictions of the bronchia, and the *effervescences* of the blood.

Sir J. Floyer assures us, that “ the “ Periodic Asthma depends on the constriction of the bronchia and bladders of the “ lungs, by windy spirits:” a state of the lungs which had never been proved, and which might therefore very properly have been neglected, till a well digested examination of conspicuous appearances had been decidedly inadequate to explain the cause, or to afford indications of cure. It has, however, been shewn, that Sir J. Floyer did not omit to remark the extraordinary excess of contraction in the respiratory muscles of the breast and abdomen; and thus far he obeyed the injunctions which he has given to succeeding physicians, “ of describing all sensible phenomena.”

It will soon appear how difficult a task it is to avoid inconsistency, when this plain ground is deserted, and the mind of the philosopher, impatient of slow progress and careful induction, launches into hypothesis.

The doctrines which have been established by Floyer, Hoffman, and Cullen, on the proximate cause of Asthma, are now accepted without much debate, as affording the easiest solution of the curious symptoms of that disease; and if the practice in treating it had been successful, it would be at least useless, if not invidious, to condemn critically the principles on which it was pursued; we have, however, a confession of the greatest weight to excite the scepticism of practitioners. No instrument has yet been discovered, which, in the opinion of Dr. Cullen, can certainly remove Asthma; and we may therefore rationally object, that the cause assigned by the Professor is no useful direction to a cure, and may be even doubted in its existence. I shall occasionally observe the sentiments of these writers, as the progress of the Inquiry may introduce the subject of their doctrines.

Hoffman, treating expressly only of the Spasmodic, Flatulent, or Convulsive Asthma,

attributes this form of the disease to various extraneous causes.* He testifies to the presence of œdematous feet in many instances. “*Supervenit cachectica corporis defædatio, cum tumore pedum œdematoso, hydrops pectoris, vel etiam ascites, ac anasarca.*” When the blood oppresses the heart and pulmonary vessels by its quantity or force, we have the Spasmodic Sanguine Asthma. When this condition falls upon hypochondriacs, whose primæ viæ are distended with flatus, the Spasmodic Flatulent Asthma appears. But, strictly speaking, the convulsive is without the presence of a gross material cause, depending only on a *spasmodic constriction* of the respiratory muscles, but chiefly the membranes investing the pulmonary cells. In pursuing the cause of this spasmodic constriction, it is said to be virulent and subtle matter falling on the nerves, from the repulsion of sweats, of exanthemata, or the excretion of acrid lymph; from the retrocession of the gout or rheumatism. It is excited by metallic fumes, and the exhalations of aqua fortis, and by wounds of the diaphragm.

The same species of Asthma arises from the receding of swellings in the feet of cac-

* Hoffman, Tom. III. Sect. II. Cap. 2.

hectic subjects;* for the serum which stagnated in the lower extremities is absorbed and carried to the lungs, and occasions extreme anxiety, difficulty of breathing, and sometimes sudden death.

The relation between œdema of the feet and Asthma, is established by repeated observations of Hoffman and others. When one disappears, says Frederic Hoffman, the other is immediately excited, and vice versa. “Notatu est dignissima solutio Asthmatis, ac œdematis pedum, per diuresin copiosior, rem, veluti diabeticam. Hæc omnino in tali casu pro critica habenda est,” &c.†

And yet this writer takes the distinction which is still preserved of convulsive and humid, or pituitous; but the only evidence of a different disease which he exhibits, is in his consultations, and there we find Case LXXXIV. called a Humid Asthma; an examiner of the symptoms will, however, not find a particular reason for the refinement; for this Humid Asthma is said not to be confined to the breast. “Sed et in hypochondriis sedem suam habens, ut adeo dyspnœa

* Hoffman, Tom. III. Sect. II. Cap. 2. §. XVI.

† De Asthmate Observat. V. Epicrasis. 1,3.

“ hypochondriaca simul jungatur, cujus effectus in partes pectoris redundat, ob nervorum recurrentium cum negotio respirationis connexionem.”

According to Hoffman, then, the Humid Asthma and Spasmodic Flatulent have causes in common producing both, the effects of which are so frequently the same, as to be subjected to no permanent rule of distinction.* This observation will be abundantly confirmed by reference to the cases of Asthma which he calls flatulent, spasmodic flatulent, spasmodic and convulsive, hypochondriac, &c. in all which the indications arise from *irritating causes*. A critical expectoration of mucus, the hydropic diathesis, and dyspepsia, very frequently occur in the same subject, but with no certain constancy.

Hoffman admires the description of Aretæus with great reason, and even accepts it as his text in explaining the disease. This accurate writer did not omit to mark the expectoration of *frothy aqueous matter*; finally, in a fatal event, *suffocation*; in a fortunate

* Vide Tom. III. Sect. II. Cap. 2. § X. XI. necnon conspiciendo Tom. IV. Consultat. & Resp. Med. Centur. I. Casus LXXXIV. XC. XCI.

one, *free and moist expectoration, with copious urine and watery stools.**

Aretæus informs us, that the disease terminates in suffocation generally, not often in recovery; and we may collect from this prognostic, how necessary it is to receive with diffidence the artificial division which nosology has created in diseases. It is extremely probable, that this observing Greek applied the phænomena of Asthma where they would uniformly appear, in diseases of great irritation and oppression of the pulmonary organ; for the account before us must embrace many cases of stronger influence on the actions of life than those which the generic term of the present day can be made to comprehend.

Cælius Aurelianus presents a feature, which we have copied, supporting the prognostic of Aretæus; and the case in Dr. Beddoes's Reports is additional confirmation of our pathology. It is highly probable that the Suffocative Catarrh appeared to the ancient physicians a form of Asthma, because in that affection the same sensible phænome-

* Aretæus, Lib. III. Cap. 11.

na would appear, and pyrexia (not always present) would alone mark the difference.

Cullen has followed his predecessors in marking as a diagnostic symptom the afflux of serum to the lungs in the following words: “Cum spūto mucī sæpe copioso.”

It is scarcely to be supposed that he was deficient in comprehensive conclusions; and yet it is obvious, that mucus could not have been expectorated without a previous secretion of *serum*, of which he takes no notice.

If this separation was established, in what quantity had it taken place? The excretion was *copious*, and the effusion must therefore have been very considerable.

What condition of the lungs admitted of a considerable effusion of serum? It is known that the mucous glandules of the trachea and bronchia are subject to too great activity from causes inducing inflammation, and that in Catarrh an excretion of mucus is considerable from this condition of their vessels; but is there pyrexia in Asthma, or are there symptoms of local inflammation? Practitioners have generally testified, that such a state is absent in Spasmodic Asthma.

Whence then this copious excretion of mucus? There are vessels with exhalent orifices at the extremities of the air pipes, and these vessels effuse serum, as well as the glandules of the pipes themselves: the construction of these exhalents is not complex, as in the mucous glandules; they have not follicles in which they deposit their lymph till it is excreted; but without a convolution of the capillary arteries, the finer fluid is directly poured into the vesiculæ. Having arrived at this source of mucus which is excreted, many reasons may suggest themselves for this being the principal, if not the only reservoir, for the copious expectoration in Asthma.

It is extremely unusual to find Catarrh without fever; and the afflux of serum which oppresses the breasts of old people, is most frequently attended with pyrexia, if the disorder does not wear the form of Convulsive Asthma in the periodic or continued excess of respiratory labour. There may be, therefore, an excretion from the mucous glandules, to furnish part of the matter expectorated, but in consideration of the absence of pyrexia, it is improbable that this secretion can afford all the mucus which appears.

The capillary vessels are considered by many physiologists as glands intended to secrete the mucus on the membranes of all the surfaces of the body; but in the effusion from the pulmonary capillaries in Asthma, there can be little elaborate preparation, because the matter of heat, as in other instances of glandular separation, is not given out necessarily in greater quantity, but from the condition of the habit in regular cases in much less.

The capillaries are here passive, and yield to the impulse of the arterial contents without any extraordinary action in general cases, though not always, from the complication of causes where the disease is not settled in its simplest form; we must therefore conclude, that the quantity of fluid which oppresses the air cavities of the lungs in Asthma, is the effect of a morbid state of the capillaries, which in health exhale a thin vapour, but in their atonic state effuse a condensed liquid.

With this explanation we may account for the presence of so much accumulated serum in the vesiculæ of the lungs; where there are no convolutions of vessels to be denominated glands, their office being sup-

plied in a more simple manner by the arterial capillaries themselves, which are liable, in Asthma, to little or no inflammation, but to frequent torpor and quiescence.* In this state there is no active secretion, as in the case of glands, but the fluid is rather permitted to escape; the *vis a tergo* being equal to propel it, but the constitutional and inherent tone of the extreme vessels being so inirritable as to be insensible of its stimulus in their capillary branches, and the area of the vessels is therefore not contracted to such a diameter as will detain the gross part of the current. There is as little difficulty in assenting to the position of a torpor of these capillary extremities, as to their increased activity. In one case we must allow the principle of a power of contracting, independent of the trunks from which they proceed; and, in the other, a debility which does not proportionally correspond with the tone of the larger vessels. The latter state is as consistent with physiology as the former, and each may be reasonably allowed to exist in different habits.

* *Torpor* and *Quiescence* appear to me properly expressive of the condition of a capillary vessel, which is not irritated to contract by its contents; but I am not certain that my application of these terms corresponds with the meaning of the learned author of *Zoonomia*, who introduced them.

The exquisite labour of respiration is conformable to animal laws under the oppression of this fluid, notwithstanding the inoffensive quality of it, for the texture of the lungs will permit nothing to remain that is unnecessary to the exercise of its functions, and the cavities being appropriated to the reception of air, immediately become sensible of the embarrassment of the grosser fluid.

Floyer is disposed to deny in general convulsions in any of the expiratory or inspiratory muscles, yet he allows these * “ Convulsions or twitchings” upon extremities of labouring and suffocation; but his † description of the contractions of the muscles of respiration, during the paroxysm, would sufficiently shew their convulsive efforts, without this particular concession.

These inordinate motions may seem inadequate to the effect by counteracting the purpose of their excitement, but in the early condition of the complaint a quickness of respiration precedes the paroxysm that by the increased exercise of this function, and yet not violent, the expirations may carry off in vapour the serum in the cavities; the action of the absorbents is quickened, it is probable,

* Floyer, p. 50.

† See his Treatise, p. 7.

in the same proportion, and by the united powers of these instruments, the balance is attempted to be restored between absorption and exhalation. If they are equal to the task, nature makes no more efforts to obtain her purpose, and a certain state which would soon be inconsistent with health, is altered by an unobserved but active force of two combined powers. If this object is not accomplished on account of the continued prevalence of the predisposing or exciting causes which prevent the returning contractile tone of the exhalent orifices, or if the lymphatics are unable to perform their share of the work, the energy which has been described will certainly take place. It then may suffer such an increase as to be itself a disease, even after the morbid irritation is removed, particularly when the frequent recurrence of the disorder has induced upon the organ, the habit and force of associated motions. “For,” says Dr. Darwin,* “all the fibrous motions, whether
“muscular or sensual, which are frequently
“brought into action together, either in combined tribes, or in successive trains, become
“so connected by habit, that when one of
“them is reproduced, the others have a ten-

* Zoonomia, Vol. 1. Sect. x.

“ dency to succeed or accompany it.” This extraordinary energy is not destitute of intention and use, as doubtless it becomes an indication that an organ is irritated, and its functions disturbed, and the paroxysm will be repeated at intervals till this indication is answered efficaciously by the physician, or the powers of the system are exhausted in its efforts.

In the same manner Acrid Bile in the intestines occasions extraordinary peristaltic motion, and if that irritating material is not discharged from the bowels by the ordinary exercise of their powers, an inverted motion will arise, equally counteracting the means of relief, as does the violent action of the respiratory muscles in Asthma. Ileus is then produced, where less sensibility of injury, and less exertion to remove it, would have been answered by a restoration of regular discharge.

In menstruation many delicate females undergo great agony before the uterine vessels have unloaded themselves, and the excess of convulsive effort which is exerted in this periodical effusion must be often moderated by opium, before the excretion can proceed with success. In parturition, the difficulty

brings on similar contractions, which the sex can distinguish from those pains which are useful to forward the birth. Here, too, opium, in proportion to the urgency of convulsive efforts is necessary to abate them, that nature may have the advantage of her own direct and unembarrassed throes.

In tenesmus acrid feces are to be expelled from the rectum, but the convulsive actions of that bowel are extended and become more acute, embarrassing the effect which would have been produced by more moderate motions.*

Irritation produces, in the pulmonary system, effects different in quantity, and manner of exertion, according to the part of the organ on which it is imposed. If a drop of the most limpid water falls into the larynx, it excites a more violent cough than the effused serum in the vesicles at the extremities of the wind-pipe. This shews the difference between a catarrhal cough and an asthmatic one, the lymph accumulated in the vesicles is rather oppressive than acrimonious, and the sensibility of their membrane is less acute than that of any part of the bronchia,

* See Alex. Monro, sen. on the Nerves, p. 276. Zoonomia, Vol. 1. sect. XVII.

and still more dull than the membrane of the trachea. There is therefore less of cough in the paroxysm of Asthma, both because the vesicle is the chief seat of the disorder, and the subsiding of the vesicle in expiration is rendered impossible by its cavity being occupied by distending lymph. This is the true cause of a paroxysm of Asthma commencing with little cough, and that seemingly impeded in its effort; after absorption has lessened the quantity of fluid, and respiration, though imperfect, has discharged some, the remainder is more controulable, and the internal elasticity of the bronchia being restored answers progressively more perfectly to the stimulus exciting expectoration.

But though the internal activity of the lungs has been thus diminished, the motions of the respiratory muscles, which are nicely associated with the sensations of the bronchial and vesicular linings, are induced to assume violent contractions, more energetic and convulsive, because this internal action is suspended and oppressed, and incapable of relieving the system of air pipes by the usual means.

Professor Cullen sums up his pathology on Asthma, in the following words; "From

“ the whole of the history of Asthma now
“ delivered, I think it will readily appear,
“ that the proximate cause of this disease is
“ a preternatural, and in some measure a
“ spasmodic constriction of the muscular
“ fibres of the bronchia; which not only
“ prevents the dilatation of the bronchia
“ necessary to a free and full inspiration,
“ but gives also a rigidity which prevents
“ a full and free expiration. This pre-
“ ternatural constriction, like many other
“ convulsive and spasmodic affections, is rea-
“ dily excited by a turgescence of the blood,
“ or other cause of any unusual fulness and
“ distention of the vessels of the lungs.”*

There are many difficulties to encounter in receiving this theory. But it cannot fail to strike the medical inquirer in the first instance that the cause which it assigns is inconsistent with the doctrine inferred, if not advanced, in treating Dyspnœa, a disease which comprises many cases of the continued species of Floyer. The experience of former writers had placed these cases of difficult breathing under the head of Asthma, nor can subsequent observation urge any objection to the term which is sufficient to over-

* Cullen's Practice, MCCCCLXXXIV.

turn their authority. The absence of one symptom of the number which characterize the disease, is not an adequate reason, whilst the remainder prevail with uninterrupted violence.

It has appeared that the material giving irritation in the continued species, produced the same difficult respiration, as marks the disorder in the periodic, but Cullen is satisfied with passing Dyspnœa in a superficial manner, without attributing the affection to any cause but the extraneous substance which irritates the organ. He does not expressly say, the affection is owing to this proximate cause, but he infers that the cure of Dyspnœa must proceed upon the indication of removing it, and it is clear from his description of the species under that genus,* both in his nosology and practice, that there can be no probable success expected from any other.

What then is become of the preternatural constriction in cases where its interference is as necessary in explaining the symptoms, as in the Spasmodic Asthma? It will be replied, that the sudden and periodical attack of the paroxysm in the Spasmodic Asthma, is only to be accounted for by the spasm of the bronchia

* Nosologia Methodica, G. LVI. Practice, MCCCCLXV. MCCCCLXXII.

in one kind, whilst in the other, the cause is permanent and the symptoms are therefore continued. But constriction from spasm is not necessary in explaining the invasion or the intermission of the symptoms in the Periodic Asthma, as the intervals in which these symptoms are absent, may be satisfactorily accounted for in greater consistency with the simple rules of natural life, and with the phænomena of the other species; at the same time it is to be recollected that a perfect intermission is not an essential diagnostic of this form of the disease.

On the contrary there will be the greatest difficulty in assuming, that spasm occasions the symptoms of respiratory labour in the continued species; and this had probably been apprehended by Dr. Cullen, or he would not have passed the subject of Dyspnœa with such slight consideration of the phænomena attending it. In this affection the straitness of the chest is more or less considerable; the wheezing is not always present but frequently occurs; the expectoration is very uncertain, as, according to the extent and violence of the predisposition, mucus may or may not constitute a portion of the irritating material,

We have, in fact, all the symptoms of Periodic Asthma, in train of succession, but not constantly together, prevailing in the species considered as symptomatic, though in the pathology of this, spasm has not been mentioned. In the Periodic Asthma, there is no certain and fixed time marked by the absence of Dyspnoea; for though this affection of respiration frequently ceases at the termination of a paroxysm, when Asthma wears its most distinct and simple form, yet very commonly a certain straitness and uneasiness in the chest, which is the same state of the lungs that in the paroxysm has been attributed to spasm of the bronchia, will continue, attended with expectoration, more or less copious, and some wheezing; still we have Spasmodic Asthma, modified in its force, but rendering the condition attributed to the bronchia very improbable, because spasm cannot be expected to subsist without relaxation for a great length of time, in opposition to the force of remedies and the alternating order of muscular contraction.

The author of *Zoonomia* says, “ after
“ animal fibres have for some time been ex-
“ cited into contraction, a relaxation suc-
“ ceeds, even though the exciting cause

“ continues to act ;” * a position which he elucidates with many important analogies, and which is supported by the authority of all experience.

Dr. Ryan † perceives this continued state of the symptoms between the fits ; but finding an obstacle in accounting for it in the physiological truth, that spasm must alternate with relaxation, he hazards a doubt of that principle, but not with such reasons as can supersede the support of experiment in its favour.

As applied to the affection of the bronchia, it is unnecessary to introduce the objection, because this may arise from causes more manifest to the senses ; and I quote his observation only in testimony of the fact, that there is not always an intermission of the symptoms, though the paroxysm may be periodic.

Dr. Withers ‡ finds the same state of Dyspnoea as Dr. Ryan, between the paroxysms of Asthma, which he explains very

* Zoonomia, Vol. I. Sect. XII. I. 3.

† Observations, &c. Chap. I. ‡ Treatise on the Asthma, p. 10.

justly by the presence of phlegm, or some material offence in the air vesicles of the lungs, which harrasses the patient till it is discharged by coughing. This author has not, however, pursued the truth, though he saw the road to it; for he takes the distinction of Humoral and Convulsive Asthma;* and according to him, it is only when they are joined that the Dyspnoea continues between the paroxysms: he therefore assents to a portion of the theory which I endeavour to advance. There is a Humoral Asthma, when serum lies in the vesicles of the lungs, and produces extraordinary effort of respiration. We must wander in perpetual inconsistency, if, after finding the cause of certain excessive motions of the muscles in one instance, we do not apply its principle to similar motions in other affections of the same organ, though in these the material may be more subtle which embodies it, and the investigation in proportion difficult.

* Is not every Humoral Asthma convulsive? If the unfortunate patient has so little irritability as not to be excited to cough, (a convulsive action,) the phlegm must suffocate him, if the absorbing vessels do not carry off the load of mucus. But though the Humoral Asthma must be convulsive, Convulsive Asthma is not always humoral, for we shall see that irritation may subsist in a more subtle form than lymph.

Had the Professor examined without the prepossession of a certain theory, the state of the vesicles in Asthma, he would have found in the prosecution of his search such appearances,* as aided by the knowledge of predisposing causes, and his observation of a predominant symptom would probably have led him to a proximate cause, as free from conjectural hypothesis, as distinguishes his cause of Apoplexy. In that disease he has taken fixed and certain marks in the morbid alteration of the vascular structure of the brain.

A similar condition would have served for the proximate cause of Asthma, if transferred to the vessels of the lungs, and would have better supported the consistency of his description of symptoms attended by “a copious expectoration of mucus.” If a spasmodic constriction is a state necessary to the pathology of the disease, it surely may be better defended as a symptom consequent of the effusion, than the effusion can be supported as a symptom of the constriction.

But though circumstances will not encourage the assumption of Spasm of the bronchia as a part of the paroxysm of Asth-

* See Anatomical Observations in Sect. VII.

ma, it is not intended to deny positively this condition, since there are no premises of observation or experiment to furnish authority of conviction, when discussed.

The lungs have little sensibility, and are supplied very inadequately with nerves. In Catarrh there is no mention of spasm of the bronchia, though these air pipes are so frequently the seat of that affection. Is a state to be assumed whenever the pathologist is embarrassed, to see clearly the cause of the symptoms? If conjecture is thus admitted to take place in inquiries which should be only prosecuted by attending to the index of natural appearances, and by pursuing the inductions which they afford, there can be little difficulty in erecting systems, whilst imagination can lay a basis, and a moderate knowledge of physiology prevent any gross errors in the execution of the superstructure. In Phthisis, the substance of the lungs has been almost wholly destroyed, but spasm has not been called in, though the quality of the expectorated matter may be conceived to irritate the bronchia, when large masses in succession are passed through their apertures; and though this disease, as well as Asthma, induces occasionally an excess of labour in

respiration, when the oppression of matter in the vesiculæ excites the muscles to relieve the organ.

There is no support given to the theory of spasmodic constriction of the bronchia, by any anatomical observations with which I am acquainted.

Ruyfch has, indeed, three relations of dissections, which may at first view create a doubt, but which cannot be admitted as any evidence of the existence of spasm, after the slightest consideration.

Observation XIX. of this writer relates to a virgin subject, forty years of age, who died after suffering complicated diseases, distinguished by dropsy and orthopnoea. The abdomen was found to contain water, the peritonæum was thickened, the omentum schirrhous, the intestines contracted, the spermatic veins so dilated as to admit a writing pen with ease, &c. the lungs adhered to the pleura, the heart larger than usual, and more water in the pericardium than common; the right kidney inverted. (Exhibited in a plate.) But in the lungs

he points out the curious circumstance of a collection of pellucid vesiculæ, expanded with air, and so obstructed as not to be evacuated of this air by some degree of compression; nor could he blow air into these vesiculæ, as there was no communication with their cavities from the trachea; but a violent impulse ruptured some of them, &c.

The case was too complicated to be classed with instances of purely Spasmodic Asthma; and the obstruction must have been occasioned by inflammatory adhesions of the coats of the air pipes, as there was no sort of aperture; and the adhesions of the pleura prove the pneumonic inflammation which had preceded death.

The two succeeding observations are histories of similar discoveries, in patients who had been affected with Dyspnoea, and Ruysch concludes, that such a morbid state must occur oftener than has been taken notice of by authors, from the difficulty of obtaining permission to open bodies.*

These instances belong to the class treated in the first part of the inquiry, as clearly as

* Vide Frederici Ruyschii Opera, Tom. I. Observ. XIX. XX. XXI.

any cases arranged by Floyer, under the continued species, or by Cullen, under the genus *Dyspnœa*.

But whilst the silence of authors is a negative testimony that this spasmodic constriction of the bronchia has not at present been found in convulsive Asthma, we have on the other side some affirmative support of our confidence in the opposite condition.

Dr. Stark informs us of the state of the lungs, in cases of tubercle or vomica, which though not a part of the disease now under our consideration, may be allowed to give an irritation sufficient to account for spasm, if the internal texture, and œconomy of the organ was susceptible of this affection from causes inducing Asthma. He says, The blood vessels as they approach the vomicæ, are suddenly contracted; their cavities being obstructed, as it appears by the endeavour to inject or blow through them.

The air vesicles contiguous to tubercles or vomicæ, are impervious to air, but as to the branches of the trachea, “ *these are never found* “ *in any degree contracted.* The internal surface of those which opened into the large “ vomicæ was of a deep red, (seemingly from

“ the enlargement of vessels) and the internal surface of the trachea itself, was partially red.”*

Dr. Cullen assigns a turgescence of the blood as the occasion of spasmodic constriction of the bronchia, but in vomicae the vessels shew marks of inflammation without any constriction of the air pipes following this condition of the blood vessels.

Dissection then has not elucidated the mystery of spasmodic constriction of the bronchia, but it will be replied, that the spasm is relaxed before death, and thus eludes the examination of anatomy. It is, however, remarkable that this state of constriction has not appeared in some instances after death, when an attendant disease of more rapid and fatal progress than the Asthma, may have finished a patient under the dominion of the paroxysm of the latter.

But what is the pathological state of a dying person, conquered by the force of any other disease, which has not by exhausting the irritability of the system, deprived the subject of all muscular energy on the verge of his departure?

* Dr. Stark's Works, p. 28, 29.

The same laborious action of the respiratory muscles takes place in the last scene, though their power will be diminished and their convulsions not so vigorous. The effort is here made to inspire fully, that the blood stagnating in the pulmonary vessels may be driven to the left side of the heart, and the last attempt of the function is that of inspiration. The symptoms occur from necessity, because through the weakness of the heart, and its irritability being diminished, nature is unable to propel the blood through the lungs; its delay becomes an exciting cause of new exercise of respiration, that the organ may be freed from the oppression. This energy is not equal to counteract the general debility, which at every pulsation is discovered to labour under increased distress. Death closes the scene introduced by symptoms which justify the expression of the philosopher, "*that Asthma is a contemplation on death.*"

As the act of dying is so very generally attended with muscular efforts similar to the paroxysm of Asthma, and yet no appearance of spasmodic constriction of the bronchia has been discovered by dissection, it is fair to conclude that it was not a part of the last condition of the lungs.

In Asthma the paroxysm is the natural effort of the system to inflate the vesicles of the lungs against the impediment of a cause mechanically filling their cavities. And in dying it is the last energy to obtain the same effect in opposition to the accumulated blood, which, from the increased debility of the heart, cannot be propelled through the pulmonary vessels.

In both an obstructing fluid irritates the organ to its exertions. In Asthma, the obstruction is temporary, and the symptoms disappear with the irritation; in the paroxysm of dying the oppression grows stronger as the strength of the heart, and the irritability of the system becomes less able to conquer it.

As there is no denial of the excessive action of the respiratory muscles excited by the distress of the pulmonary system, it is matter of great surprize that it should not have been more particularly noticed by writers, and a supposed spasm refusing admission of air into the bronchia, pointed out with distinction as a proximate cause. Cullen could remark that a remission of the fit “be-
“ comes immediately more considerable, if
“ the cough brings up some mucus, and that

“ a much wished for sleep succeeds,” and not be struck with this critical effect of partial expectoration.

Every man who has sustained the paroxysm is convinced that something is to be discharged from the lungs: a spasmodic constriction of the bronchia he is not certain of, nor can the most acute physiologist ascertain such a condition. The exertion of the muscles indeed are noticed to be laborious, and calculated to operate a great effect. Their action may be seen and felt, and it is very possible that the influence which excites it may be extended by the branches of the par vagum over the ramifications of the bronchia; this influence and its extension are directed to the same object, but the extension is not seen, and can only from analogy be supposed, and even then with some embarrassment from physiology, which never deviates from representing the internal structure of the lungs as little irritable and scantily supplied with nerves.*

All the phenomena of the paroxysm may be accounted for from the necessity of pumping up or expectorating lymph, which being

* Vide Haller Element. Physiolog.

too copious to be duly carried off by the absorbents, and the act of expiration, stagnates in the vesicles and bronchia.

In expiration, the air should be expelled from the lungs, carrying with it the fluid lymph in form of vapour; inspiration should therefore bring air to the extreme internal surface of the vesicles. If air has not arrived at the bottom of the vesicles, the lymph contained in them will not intervene between the source of the current and its issue; it is therefore an attempt of relief that is exercised in the act of inspiration, as well as expiration, but difficulty accompanies the operation, because these vesicles have their cavities filled with lymph, which is the cause to be removed.

The bronchia also, whose internal membrane is intended to effuse a lubricating moisture only, submit to the condition which prevails in the vesiculæ, and the passage of the air through these pipes is much narrowed, though not closed up; hence *wheezing*, both in inspiration and expiration.

A spasmodic constriction of the bronchia has not only been considered as the proximate cause of the disease, but as peculiarly inducing the wheezing, which is remarked so

generally in respiration : if this be the case, we may fairly expect to remove this diagnostic symptom by the usual antispasmodic medicines, and more particularly by the exhibition of opium ; it will, however, be seen, that a large dose of opium merely abates the too great efforts of the respiratory muscles, and leaves this peculiar proof of spasmodic constriction where it was. There has been no experience of the air having been inspired or expired without wheezing, in consequence of antispasmodic remedies ; nor did the paroxysm remit, or the disease terminate, without expectoration. The effect of the opium shews itself upon the nervous system generally, and not in particular application, by the removal of local spasm. In spasmodic contractions of any particular muscle, opium discovers a specific efficacy when given in a proper dose ; the spasm will relax, and no bad effects result from the remedy to the functions of the system. In Asthma, on the contrary, opium will indeed blunt sensation and uneasiness, and the contractions of the external respiratory muscles will be less violent, but the disorder proceeds to its usual termination, and the physician must be convinced, that the drug imparted no specific

virtue to suspend a local disease, because the patient will have its whole power to contend with, in addition to the inconvenience it was intended to remove.

Floyer* remarks, “ that the bronchia
“ are contracted or straitened, which pro-
“ duces the wheezing noise in expiration :”
and afterwards proceeds to say, “ that this
“ symptom does not depend on phlegm, is
“ plain, because the hysteric, who have no
“ phlegm, wheeze very much.” But Floyer
had not the full advantage of an expanded
knowledge of the absorbent lymphatics, or
he would possibly have seen a mode of re-
moving extraneous fluid by their operation
in this instance of Hysteric Asthma ; for
when wheezing appears in that form of dis-
ease, in which spitting does not terminate
the fit, it is highly probable, that absorption
has been exerted to the full effect of re-
moving the lymph, which had really been
effused in the hysteric, as well as the species
we are now treating ; and, independent of
this consideration, there are other causes
mechanically compressing the trachea, suffi-
cient to account for wheezing when it really
takes place in the Hysteric Asthma.

* Floyer, p. 43.

Notwithstanding the above observation of Floyer, an attention to his own feelings produces, in another place, a declaration which points out a sense of the strictest connection between the cause of his disease, and the spitting which accompanies it. He says, “ all the lobes of the lungs are not
“ constricted alike : for, in the fit, I could
“ never breathe tolerably if I lay or leaned
“ on the left side, which made me very
“ sensible, that all my straitness lay on the
“ right side of my lungs, and that inclined,
“ or naturally occasioned me to lie on that
“ side during the fit ; but after the fit was
“ over, I always lay easiest on the left side.
“ I perceive the right side to be most affected in my case, and from thence all
“ the spit does plainly rise when the fit
“ goes off.”* Considering the distention of the stomach from flatus, it may be casually observed, that it is extraordinary Floyer did not attribute his uneasiness in lying on his left side, to the pressure of that viscus against the diaphragm, but, it surely is very remarkable, that having ascertained, by his reason and his feelings, that the disease lay particularly in one lobe, and that spitting

* Floyer, p. 8.

evacuated the vesicles of that lobe, when the disease left it, the other side being comparatively free from complaint, he should not have preferred uniting cause and effect from plain evidence of their relation, and neglected a theory of constriction which had never been proved.

In another place he says, “ that * in the Humid Asthma the lungs do not appear to be much oppressed with phlegm before the fit, and at the end of the fit the straitness goes off, before any considerable quantity of phlegm is spit up, which would not happen if the straitness depended on a great quantity of phlegm.”

The *straitness* cannot be accounted for by the pathology of Floyer, but we see the implied fact of a strict coincidence of this affection, and an accumulation of phlegm. This straitness is a sensation not readily to be defined, but it results from the same general condition of the pulmonary system as induces the other phenomena; more particularly it arises from the diminished sum of the cavities, which should admit air in inspiration. The vesiculæ are occupied

* Floyer, p. 7.

by lymph, the bronchia are straitened in their area by the same cause, in a more viscid state, the diaphragm cannot descend as it used to do, on account of the resistance of the stomach, filled and distended with flatus, and the trachea is probably narrowed by the compression of the œsophagus, affected like the stomach; it is in this condition that the external respiratory muscles endeavour to dilate the thorax, by lifting up the ribs and sternum, which evidently cannot accomplish the object of filling the air cavities, which are obstructed, or of forcing down the diaphragm, whose own contractions had been inadequate to oppose the resistance of the stomach; a *straitness* is then felt from these obstacles to a capacious inspiration, and not merely from the presence of phlegm.

But phlegm could not be expectorated at all, if it had not been effused in the fluid state of lymph, in which state it becomes oppressive to the pulmonary organ, and excites a nifus to remove it. The inspissated form in which it is first expectorated proves the necessity of some delay in the vesiculæ and bronchia, to render it thick; and though the straitness goes off before any considerable quantity is spit up, the patient enjoys imme-

ciate relief from a small excretion. But the *straitness* proceeds from the concurrence of the above causes, and will be relieved, as any one of them is induced to submit. The *wheezing* depends only on the diminished capacity of the air pipes, and continues generally through the disease, progressively becoming less, till the secretion of mucus in the bronchia is reduced to regular quantity, and the distended state of the œsophagus no longer compresses the trachea, when it ceases.

It appears, then, that notwithstanding the remark of Floyer, the straitness of the breast must be materially connected with the internal state of the lungs. There must be a point of time when the silent activity of the absorbents has effected some change in the quantity of serum accumulated in the air cells and bronchia, and there must be a degree of oppression from the influence of this serum, which being taken off at that time, will permit the return of some elastic action in the bronchial rings and vesicular membranes; relief will therefore be perceived in the breast before excretion of phlegm takes place, but not before the mucus has been reduced, by absorption, to a quantity which the internal elastic force of the vesiculæ and

bronchia can in some measure controul. Expectoration then partially proceeds, with that indescribable sensation of ease and satisfaction, which the patient will not hesitate to welcome as critical.

An accurate observer of affections of the breast, supports this opinion of the cause of wheezing; "That peculiar noise," says Dr. White, "in breathing, which we term "*wheezing*, arises commonly from the "branches of the trachea being stuffed up "by mucus or pus."* This sound in Phthisis has thus been attributed to its natural cause, because the weight of authority had not biased the observer to impute it to Spasm. But wheezing in Asthma is the same sound as is heard in Phthisis, and there is sufficient evidence of the occasional state of either disease being an adequate cause of that symptom.

To confirm this explanation it has been proved, that such an affection absolutely accompanies the condition of a person resuming his functions after suspended animation from drowning, when water had been received into the lungs. Dr. Goodwin informs us,

* Observat. on Phthisis Pulmonalis, by W. White, M. D.

that when the functions return, “ a difficult
“ and stertorous respiration is observed.
“ This inconvenience arises from some wa-
“ ter still remaining in the lungs, which
“ will be gradually evaporated by the ex-
“ pired air.”*

* Goodwin on Animal Life and Respiration, p. 118.

 SECT. IX.

Asthma compared with other diseases, bearing analogy in their causes. — Catarrh. — Phthisis. — Asthma, Lethargy, and Apoplexy, following intermittents and pneumonic inflammation. — The intercurrent of these affections. — Asthma is a temporary Dropsy, distinct from hydrothorax and anasarca of the lungs. — Asthma, Dropsy, and Insanity.

THE signs of an Asthma are so strongly marked, that there can be no difficulty in acknowledging the disease to any person, who has once observed it; yet it will elucidate the subject, to shew its distinction from some other diseases to which it may bear an analogy, more or less conspicuous in its causes and effects.

Defluxions on the upper part of the lungs and Sneiderian membrane, have been displayed as follows :

“ *Si fluit ad pectus dicatur rheuma Catarrhus :*
 “ *Ad fauces Branchus, ad Nares esto Coryza.*”

These are usually inflammatory affections, in which there is too great a secretion from the mucous glands which line the passages of the nose, fauces, and trachea, as far as its divisions, and possibly lower in the breast, but not extending to the extremities of the air pipes.

Catarrh evidently is the effect of a more elaborate secretion of mucus than can take place in the vesiculæ, and the secretion is attended with the evolution of heat. The disease arises from perspirable matter, suppressed on the surface of the body, and determined to this membrane, or more probably from a torpor of the membrane itself, succeeded by increased action of its vessels; for *Catarrh* is attended by pyrexia, excepting in peculiar instances, when the habit is more prone to spasmodic muscular contraction, and these have been adverted to.* The lymph is deposited in cells, where it thickens, from absorption of its thinner parts, and is ready to be excreted when those cells are full. The acrimony of the discharge arises from the diseased action in these secreting glands. The capillary vessels which open into the vesiculæ, are not convoluted in the

* See Cases of Dissection, Suffocative *Catarrh*, &c. Sect. VII.

manner of glands, and exhale their fluid without appropriate cells to deposit it in; their disease is that of too little contractile tone, and their apertures are distended by the force behind, without fever, or the evolution of heat.

The catarrhal disposition is very frequently followed by Asthma, because from accidental causes a determination may be made to the lungs and mucous membrane, and the repeated inflammation of the capillary vessels and the mucous excretories, will at length induce in some habits a debility of tone on those minute orifices, which, when the phlogistic diathesis of the system is lost, will prevent their resistance to a circulatory impulse even less than healthy, and subject them to the impression of exciting causes of little force in comparison with what they formerly submitted to. For this reason elderly persons have their natural excretion of mucus very frequently much more copious, as they may have been more affected by catarrh, and they are according to the extension and degree of this affection more liable to Humoral Asthma. If inflammatory disposition is not wholly lost in these persons by the progressive debility of the vessels of the lungs, Peripneumonia

Notha will be the character of their pulmonary disease, attended often with great danger.

It therefore appears that catarrhal defluxions bear an analogy to Asthma, by falling on the bronchia and wind-pipe, or the Sneiderian membrane, but in Convulsive Asthma the effusion is lower in the pulmonary organ, affecting the vesicles at the extremities of the air pipes. In Catarrh inflammation attends more or less according to the state of the predisposing habit, but in Asthma pyrexia does not prevail, nor is the habit affected with vascular inflammation. In both diseases there is, however, an effusion of serum, and an irritation to eject it, but the construction of the pulmonary organ and the circumstances which have been explained, induces the action of different muscles to accomplish the purpose, and a different proportion of energy in the execution.

It is also consistent with the rules of the animal œconomy, that Catarrh should not be indicated by those violent contractions of the muscles of respiration which take place in Convulsive Asthma. Fever is the system of morbid actions, which in Catarrh, as well as Phthisis, is adopted by nature to relieve the body of these affections; and we

may observe, though we may not comprehend the fact, that fever generally supercedes convulsive motions, and terminates their extreme energy ; and that during the violent continuance of these motions, fever does not commonly appear.

If Catarrh occasionally leads to Asthma, it still oftener brings on *Phthisis*, a disease which depends on the state of the lungs, manifestly the reverse of that which permits ferous effusion.

In Asthma, an excess of blood in the pulmonary vessels may very probably precede the exhalation of the finer part into the vesiculæ and bronchia ; this plethora arising from the relaxed texture of the coats of the vessels, which yield to the *vis a tergo*, occasionally more forcible than common, relieves itself by effusion ; the vessels are, therefore, passive, and blood-letting is never, to my knowledge, useful, but frequently injurious.

In *Phthisis* the arterial impulse is more considerable than in health, but the predisposition of the pulmonary vessels is not favourable to a relief by exhalation, till the fever has acquired strength, and coagulable

lymph instead of pellucid serum comes to be effused. At this period the exhalent orifices are themselves inflamed, and suffer an adhesion of their sides, which prevents the transmission of the finer fluid. Whether in the mouths of these arterial exhalents the obstructing lymph does then become tubercles, as is the opinion of a judicious writer,* is of little importance to our inquiry; it is certain, that in this febrile disease of the pulmonary vessels, coagulable lymph does exist, and its viscosity is well calculated to seal up the orifices by inflammatory adhesion. If in this condition of the vessels the impulse of the blood is not diminished by bleeding, but increased by occasional causes, the consequence will be rupture of the arteries for want of that depletion which would have unloaded them by discharge of serum. In Asthma, on the contrary, whatever may be the exciting causes of extraordinary impulse in the arteries, which will be considered hereafter, the contractile tone of their extremities is so diminished, as not to resist the force.

It is therefore to be allowed, that there is a predisposition of habit, in which in-

* Vide Reid's Essay on the Phthisis Pulmonalis.

inflammation will affect the arterial extremities, and produce Phthisis, as doubtless there is a predisposition by which the habit will be subject to that atonic state of the vascular pulmonary system, producing Asthma.

There may be also an intermediate state, in which a balance is preserved between the crisis of inflammation sealing up the orifices of the arterial exhalents, and the distention of those exhalents so gradually acquired as to permit the escape of the finer fluid, and consequent relief of arterial fulness: but it is probable that this balance cannot be long adjusted where the predisposing causes have had a considerable influence, and that if the exhalents do not dilate soon in consumptive habits, Phthisis must take place; and in persons of an opposite constitution, which I conceive is favourable to Asthma, the effusion of lymph into the vesiculæ and bronchia will determine, in no long time, the future character of the pulmonary disease.

Lethargic affections have been considerably allied to pulmonary complaints in the consideration of many authors; so much so, as to create a question if the cause of lethargy did not exist in the lungs.

Hippocrates says, “ *lethargic diseases
 “ are the same as peripneumonic, and not
 “ altogether different from the humid pe-
 “ ripneumony.” (Peripneumonia Notha.)

Some of his commentators have defended this opinion by the practical remark, that lethargy is critically relieved by expectoration of purulent or serous fluid; and others have even contended, that the Father of medicine intended, by the word *ληθαργος*, to signify a disease of the breast instead of the head. Willis endeavours to reconcile these opinions by the following explanation: “ the
 “ morbid matter is often in the first instance
 “ seated in the head, and creates a lethargy;
 “ it is then absorbed, and carried to the
 “ breast, producing empyema, or spitting of
 “ pus like fluid.”†

The lethargic symptoms in Asthma and Peripneumony are sufficiently accounted for by the interruption to the course of the blood from the right side of the heart to the left, giving distention, and obstructing the influx from the veins, returning blood from the head.

* Lib. II. et Lib. II. de morbis.

† Tractat. de Anima Brutorum, p. 2, C. 3.

There are certainly striking circumstances of analogy between Asthma and *Apoplexy*, though these affections take possession of different cavities, and practitioners have generally remarked that the same condition of habit is predisponent to both diseases. Professor Cullen has assigned two states of the vessels of the brain as a proximate cause of apoplexy, and these states applied to the vessels of the lungs will be found to induce Asthma.

“ The blood accumulated in the vessels
 “ of the brain and distending them, and
 “ fluids effused in different parts of the brain
 “ or into the cavity of the cranium, and accumulated in such quantity as to occasion
 “ compression,”* are the proximate cause of Apoplexy.

In tracing further back these causes of compression of the brain, the analogy continues and is apparently strengthened. He finds them produced by any cause “ increasing the afflux
 “ and impetus of blood in the arteries of the
 “ head :”† by causes preventing the free return of the venous blood from the vessels of the head to the right ventricle of the heart:‡ by whatever occasions a difficulty in the trans-

* Cullen's Practice. MCIII. † Cullen, MCV.

‡ Ibid, MCVI.

mission of blood through the lungs:* by an effusion of serum which may occur from a relaxation of exhalents as in other cases of hydropic diathesis prevailing in the body, and from an over proportion of watery parts in the mass of blood.† These remote causes by distending the vessels of the head, by producing a morbid effusion of serum, or by both, occasion apoplexy, and by the same intervening means they cause Asthma in the lungs.

Asthma frequently terminates in apoplexy, as was observed by Floyer, and other physicians, and such an event is rendered very probable from considering the remote causes of each disease, as they are above enumerated.

Asthma is sometimes introduced into the habit by *intermittents*, which I believe are attended with *pneumonic inflammation*. It is obvious that this inflamed condition of the lungs may leave the vessels relaxed and dilatable with slight impulse to excite effusion; and from this indirect debility an hydropic effusion frequently takes place, progressively from a local disease becoming a diathesis, which may occasion apoplexy, or the delirium,

* Cullen, MCVIII. † Ibid, MCXII.

or insanity, which depends on compression from effused fluid in the brain.

We have an example in Floyer, shewing the connection of all these affections. *He remembered an apothecary who after he had been cured of an inflammation of the lungs by the usual evaculatory means, suffered returns of the Asthma, which had accompanied the fever every night, for a long time, with large spitting. Floyer attributes this state to a deficient use of the cortex. Practical observation had suggested to him the truth that inflammatory symptoms being entirely removed, the periodic returns of the Asthma should have been opposed by the remedies of an intermittent, which are tonic, and would gradually have restored the contractile power of the capillary exhalents, which had been weakened more than in equal proportion to the rest of the system, and remained affected with atony longer than any other. The evaculatory plan had also been pursued with such vigour, particularly in blood letting, as would probably leave the vessels unusually empty, and without the necessary stimulus of distention to excite their contraction. The event of the case exhibited very clearly the

* Floyer's Treatise, p. 33.

analogy between pulmonary effusion, and the effusion from the vessels of the head; “for the fever evidently returning on the change of the year, seized his head with delirium and convulsions, and killed him.” The disease thus discovered its identity, whether it affected the lungs or the head, and would probably have submitted to a temperate plan of local depletion and general corroboratives, if all inflammatory symptoms had really been conquered with the fever. In confirmation of such identity of cause, Floyer’s evidence may be again called, if evidence, where universal medical experience and reflection must support the opinion, should be still wanted. He remarks, that this stop or affection on the vessels in old Asthmatics, produces dropsy in the head, of which they always die lethargic.*

Asthma being occasioned by effusion of serum in the vesiculæ and bronchia, is truly an *Hydropic Disease* whilst it continues; but it is entirely distinct from Hydrothorax. In the latter, the serum is collected in the cavities of the thorax, that is, in both sacs of the

* Floyer, p. 47.

pleura; sometimes, only in that cellular texture of the lungs which surrounds the bronchia and vesiculæ, and then more properly called anasarca of the lungs. In each situation the fluid may be the cause of difficulty of breathing, but more particularly when it is seated in the cellular texture; but this dyspnœa will be of the continued kind, and though subject to exacerbations from accidental exciting causes, will not put on the form of the Periodic Asthma, or be distinguished by the peculiar symptoms, which, in compliance with nosology, and the authority of Dr. Cullen, physicians do now concur in distinguishing by the name of Spasmodic Asthma.

The compression from serous fluid in the sacs of the pleura, or cellular texture of the lungs, will be entirely external in its relation to the air cavities of the lungs, and must affect them by diminishing their area by compression of their sides. In Asthma the air cavities are invaded by the entrance of an unusual fluid, which cannot be long submitted to with safety of life, as depending on the function of respiration; the agony is therefore in proportion to the importance of the object in excreting the fluid; and

fortunately there is a direct outlet for the extraneous matter, if the disease has been too formidable for the power of absorption and natural respiration to remove. The necessity, therefore, of those active remedies which are given with success in Hydrothorax and Anasarca, is superseded in the case of hydropic effusion of Asthma.

Dr. Withering,* speaking of Hydrothorax, says, it is very universally cured by digitalis.

Unprejudiced minds must generally assent to the extraordinary efficacy of digitalis in this species of Dropsy; and medical science will acknowledge the clear and candid description of its effects in multiplied cases, by that judicious physician. The digitalis will not, however, cure the Asthma when it wears the form of local disease only, and the habit is not pervaded by the hydropic diathesis. The power of this herb has, notwithstanding, been so confirmed in cases of general Dropsy, that its inefficacy in Asthma may be supposed to afford some testimony of serous effusion not being the cause. But digitalis will not cure the Hydrocephalus,

* Withering's Account of the Fox-glove, &c. p. 200.

nor Hydrocele, nor any encysted Dropfy, any more than it will that of the air cavities of the lungs.

But though the particular circumstances of the organ diseased do not favour the action of some of the most powerful remedies of Dropfy, and though the condition of the vascular system of the lungs renders their interference unnecessary and prejudicial, yet there is considerable weight of evidence, that Asthma is an hydropic effusion. Presumption of this may be deduced from a consideration of the predisposing causes, which appear to produce serous effusion in other cavities, followed by Apoplexy, and from a reference to causes peculiarly leading to general Dropfy, which will also be found to be the predisposing and exciting causes of Asthma.

We have also a testimony of the close connection of the two diseases in the histories of practical authors, incessantly pointing out the intercurrence of symptoms and reciprocal changes of one disease into the other, when Asthma has been of long standing: some proof of these assertions is contained in Sect. VII. of this Inquiry.

Höffman and Willis have particularly noticed the hydropic appearances of the feet, and the tendency to general dropfy in Asthma: and the observation of these authors is supported by that of other practitioners.

Sydenham opens his treatise of the Dropfy by stating the first symptom of that disorder, which he says is the swelling of the legs, and pitting of the ankle by pressure of the finger: but this is not so certain a sign in women as in men, nor even in the latter is it to be considered as an absolute certainty of the disease having commenced. He then proceeds with the following remarkable observation.

“ Etenim cum senex quispiam, habitu
 “ corporis paulo pleniori præditus, *Asthmate*
 “ jam a multis annis laborans, ab eodem
 “ derepente, idque hyemis tempore, fuerit
 “ liberatus, mox ingens tumor musculos ti-
 “ biarum occupabit, Hydropicorum tumores
 “ æmulans, qui hyeme etiam magis quam
 “ æstate, tempestate magis pluviâ quam
 “ serenâ, pariter invalescit, et tamen sine
 “ quovis incommodo insigniori, eundem ad
 “ libitinam usque comitabitur. Quo non
 “ obstante, si generaliter loquamur, suræ et
 “ tibiæ intumescences, etiam in viris, pro

“ signo supervenientis hydropis habendæ
“ sunt; maxime si ita affecti spiritum ægrius
“ ducant.”*

This sagacious observer might have attributed the swelling of the legs, with great truth, to hydropic effusion in the Asthmatic, as well as in other cases; and the cessation of the Asthma when these swellings commenced, seems to corroborate, beyond dispute, the theory, that both affections depended on one cause. The swelling was larger in winter than in summer, in moist weather than in dry. Alterations in the atmosphere rapidly affect the Asthmatic, and change his habit from a perspiring to an imbibing state, and whether the aqueous accumulation stagnate in the air vesicles of the lungs, or be taken up by the activity of the absorbents, as fast as it is effused, and be again exhaled in the lower extremities, where the power of the lymphatics is not so successful, the identity of the cause is sufficiently plain.

Above two hundred cases are delivered by Dr. Withering, and in this collection at least twenty-eight are mixed cases, in which

* Sydenham Opera Tractatus de Hydropic.

Asthma is a concomitant symptom of Dropsy. The author observes, “ that the true Spasmodic Asthma, a rare disease, is not relieved by digitalis:” and in his cases two or three are denominated, true Spasmodic, in which the treatment had no success; in others, the patients were gibbous, presenting a mechanical obstacle to easy respiration, and a cure of the Asthma: in the remainder, the Asthma constituted a part of the hydropic diathesis of the system, and was relieved with the general disease. The Cases XXIV. and XXXIV. deserve particular attention. In the xxivth, the patient suffered alternately under Asthma and Insanity; and Dr. Withering attributed both states of the disease to one cause, which was water. The treatment founded on this opinion was successful in curing both. In the xxxivth Case, the patient sustained Anasarca and Insanity at the same time, and was cured of both by the same means. It is impossible not to infer, that effusion of water occasioned all the symptoms in each patient, and that Asthma, Insanity, and Dropsy, had the same cause; for if Insanity and Asthma were one disease, and Insanity and Dropsy were one disease, *Asthma* and *Dropsy* must be one disease.

This translation of symptoms from one organ to another has been treated under different names by several authors, but more particularly by Dr. Ferriar, who, after Baglivi, entitles the alteration of appearances, *Conversion of diseases*; but the identity of cause, if not always, is very generally to be traced through the Proteus forms of the effect.

In pulmonary affections, Insanity frequently suspends Consumption, and Consumption Insanity: Asthma, likewise, is succeeded occasionally by Insanity, even when the hydropic diathesis is not established in this instance there may be an effusion of serum from the vessels of the brain, but without this effusion the turgid state of these vessels, from the difficulty with which the right side of the heart propels the blood through the lungs to the left, is sufficient to account for the symptoms of insanity. In the hydropic diathesis, so frequently accompanying advanced Asthma, the disease of the head is still more frequent.

A lady, worn out with a Dropsy, was seized with Insanity, and remedies were then successful in removing both affections.* “ Ut

* Mead Monit. et Præcep. Med. p. 72.

“ post aliquot menses mens sana sano cum
“ corpore rediret.”

From a consideration of the causes assigned to Infanity by the learned Dr. Arnold,* there can be no difficulty in assenting to the connection between the diseases explained above.

* Observation on the nature, kinds, causes, &c. of Infanity.

 SECT. X.

The symptoms of Asthma analytically explained.

— *The diagnostics of Cullen. — Additional symptoms considered, and referred to the same causes. — Remissions of convulsive respiration. — Anxiety of the præcordia, and straitness of the breast. — Itching of the neck and breast. — Obscure heat without fever. — Dyspepsia. — Head-ache, sleepiness, and flatulence. — Nocturnal access of the paroxysm. — The power of volition in suspending Epilepsy and Asthma. — Asthmatic diabetes. — Straitness of the breast. — The union of oxygen with the blood, the absorption of heat, and the discharge of aqueous vapour. — Deficiency of oxygen from the condition of the vesicles, and consequent debility of the heart and arteries. — Polypi of the heart. — Syncope. — Irregular pulse. — Coldness of the lower limbs. — Irritability of the mind. — The intermitting pulse. — Correspondence of the stomach and heart. — Expectoration of black mucus. — The blood saturated with carbon. — General remarks.*

THE general considerations in the former Sections, the authority of past experience,

and the pathological observations of modern physicians, applied to Asthma, appear to support the doctrine of serous effusion having excited the convulsive respiration. A more particular *analysis* of the disease will not detract from this conclusion, but, on the contrary, confer additional strength on its force.

The symptoms which form the paroxysm may be explained with more consistency, as derived from the state which is here attributed to the lungs, than by any other theory at present advanced. The diagnostics of Dr. Cullen are especially combined with that condition of the exhalents which has been described.

The *Difficulty of Breathing** arises from the accumulation of serum in the vesiculæ and bronchia, by which those cavities cannot admit their appropriated fluid to the extent of measure which makes a full inspiration of air; and this very difficulty consists as much in the convulsive efforts of the respiratory muscles to relieve the organ, as in the mechanical impediment to the ingress of the air so necessary to its functions: a dif-

* Sect. II.

inction founded with great truth on an accurate observation of the phenomena, but too carelessly marked in the ambiguous words “*Spirandi difficultas*.”

The *Straitness** of the breast is a perception of uneasiness from the want of a full inspiration of air, and the diminished capacity of the air vesicles and bronchia; the opposition to the descent of the diaphragm still further preventing their expansion. This perception is not clearly distinct from that of *anxiety*, and will be further adverted to.

The *Wheezing Respiration*† is owing to the same diminished area of the cavities of the bronchia as necessarily occasions the straitness of the breathing, and possibly to the contractions of the muscular fibres of the elastic bronchia being associated with the convulsions of the external muscles; but this cannot be ascertained.

The *Cough*‡ is small, and interrupted at the beginning of the paroxysm, because the quantity of effused lymph suppresses the internal action of the air cavities at that period

* Sect. VIII.

† Ibid.

‡ Ibid. p. 163.

of the disease; but it is more free and open at the decline of the symptoms, because the oppressive fluid is so far diminished by the absorbing vessels, as to become controulable, and to admit the expirations which constitute cough.

The Expectoration of *Mucus** which then comes on, and affords relief, is the critical discharge of the very material which has offended the system, and excited the paroxysm by its irritation.

But besides these diagnostics of the Periodic Asthma, there are symptoms, which, though not constantly meeting in the same paroxysm, very generally attend the disease, and which in their explanation contribute additional support to the establishment of the proximate cause here delivered.

The *Remissions* of respiratory convulsive contractions conform to the laws of the animal œconomy, and no other reason is necessary for their alternation of exertion and rest. After a muscle has been for some time stimulated to contract, a relaxation will succeed, though the stimulating cause may

* See Sect. VI. VII. VIII.

continue in force.* Happy is the Asthmatic, who, after repeated attacks of the paroxysm, is not influenced by their impression to obey a secondary law, the effect of custom; for contractions of the muscles will continue at intervals, though the stimulus is even removed, as happens in tenesmus for some time after the exclusion of acrid excrement.†

The *Access* of violent contraction of the respiratory muscles will at least recur every evening whilst the irritating offence which excites it maintains its force in quantity; and the paroxysm only declines as a portion of this offence is discharged, and the remainder becomes less oppressive in the organ: thus, though the whole object is not gained till the paroxysm ceases, something is obtained at every remission of these natural efforts. The fits of an ague return in this manner; they intermit; they finally cease whenever the exciting cause is removed, whatever, according to the different systems, that cause may be. And this, probably, happens with still fewer exceptions from the secondary influence of custom than in the case of Asthma.

* See Zoonomia, Vol. I. Sect. XII. I. 3.

† Ibid. Sect. XII. IV. 3.

The *Anxiety* in Asthma is explained by the presence of some irritating offence to be removed ; and if that offence should belong to the pulmonary organ, we shall be more satisfied with the pathology, because it is here that the experience of physicians has long referred the perception called *anxiety of the præcordia* ; differing very little from the anxiety belonging to Asthma, and being only an inferior degree of the same sensation, which nosologists have termed “ *an-gustia in pectore*.”

Anxiety arises, says Gaubius,* when some impediment resists the efforts which nature uses to expel any internal inconvenience ; it attends when any difficulty prevents the excretion of fæces from the bowels or bladder, perspirable or mucous matter, or blood. But the most frequent cause of anxiety is a disorder of respiration, and a want of freedom in the passage of the blood through the lungs.

“ Multiplex itaque vitium pulmonis
 “ varia materie infarcti, spasmo contracti,
 “ tumore, tuberculis, vomica, ulcere obsessi,
 “ aut aere, aqua, sanguine, pure, tumore,

* Instit. Patholog. Med. 686, 687.

“ aliove thoracis affectu extrinsecus com-
“ pressi; fistulæ item aëriferæ fauciumque,
“ qua spiritus, meare debet; tum diaphrag-
“ matis ac cæterorum, qui respirationem
“ adjuvant, musculorum; aëris denique fri-
“ gore, calore, levitate, humiditate, elateris
“ defectu, situ, inquinamento, peccantis
“ multivaria labes huc faciunt.”

An *Itching of the Skin* of the breast and neck is frequently a symptom in the asthmatic paroxysm, sometimes preceding the violence of the fit, and generally declining as the agony of respiration increases; this depends upon the causes which more peculiarly occasion the anxiety and straitness of the chest, an inconvenience to be removed, and an obstruction to the circulation through the lungs, and also irritating matter in the first passages. The latter is not less frequently indicated by this symptom, than is the condition of the lungs in Asthma, for hysteric and hypochondriac patients, who suffer dyspepsia, are very much affected with it; it may also proceed from acrimony which is to be discharged on the skin, and which

* Gaubii Instit. Patholog. Med. 687.

often accompanies these complaints; but in Asthma it is usually the effect of sympathy with the internal distress of an organ, and follows the progress of its motions: in the mean time the sensation may produce some cutaneous inflammation, and the symptom then increases; but it by no means is to be considered as necessarily a part of Asthma.

The difficulty with which the venous blood is returned to the heart, from the right ventricle and the pulmonary artery being obstructed, is an additional cause of this affection of the skin.

There is sometimes in Asthma a remarkable sensation pervades the body, accompanying the anxiety of the breast, and distinguished by an obscure *Perception of Heat*, and a want of cool air. This perception of heat may have induced Floyer to talk of fever in this disease, but an attention to the pulse gives no countenance to the observation; the quickness never amounts to one hundred beats in a minute, and the general standard in uncomplicated cases is from eighty to ninety. The desire of cool air is an appetite to inhale a greater portion of oxygen, and the opportunity of obtaining it will be

increased the oftener the air is changed, or more fresh air admitted.

Cloſeneſs is particularly diſagreeable to the Aſthmatic; and Aretæus has marked the ſenſation of this inconvenience very ſtrongly in his character of the diſeaſe. The appetite for pure air is accompanied with this acute perception of bad, which depends on the ſame cauſe. “The patient,” ſays Aretæus, “loves walking in the open air, “with his mouth open, and is diſſatisfied “with the largeſt houſe, which ſeems too “ſmall to breathe in.”*

The ſenſe of heat through the body is not a conſtant ſymptom, for more frequently the lower extremities are very cold in the paroxyſm; and when the patient himſelf has the perception of heat in his external parts, there is no increaſe of temperature if the thermometer is applied to the ſkin. I have frequently conſidered this circumſtance, and I can only ſatisfy myſelf by attributing the feeling to a general ſlowneſs of venous circulation in the ſmall ſuperficial veſſels, ariſing from the impediment to a free entrance of the blood into the right ſide of the

* Aretæus, Lib. III. Cap. XI.

heart, and the compression of the pulmonary vessels giving occasion to it, whilst the vigour of arterial impulse is lowered in proportion to the debility of the heart. In these circumstances the venous capillaries must sustain their share of the general turgescence.

Dyspepsia is a condition of the habit which will be found always to have preceded the Periodic Asthma; and it comprises in its train the flatulencies of the stomach and bowels, the pain over the head and eyes, and the sleepiness, which are amongst the *terrentia* of this disease: these symptoms are therefore part of the predisposition which introduces the disorder, but which may also exist independent of its attack.

The *Attack of the Paroxysm in the night* is a peculiar feature, and gave rise to the following suggestion of the ingenious Mr. Charles Darwin.

“ *Do the periodic returns of nocturnal
“ Asthma rise from a temporary dropsy of
“ the lungs, collected during their more
“ torpid state in sound sleep, and then re-

* Vide Zoonomia, Sect. XXIX. Vol. I.

“ absorbed by the vehement efforts of the
“ disordered organs of respiration, and car-
“ ried off by the copious sweats about the
“ head and neck ?”

The supposition of the retrograde motion of the lymphatics can scarcely support this theory, because it is an uncommon crisis in Asthma which is distinguished by copious sweats about the head and neck, and the vehement efforts of the respiratory muscles are, in fact, the usual exercise of the function of respiration urged to an excess, to discharge in vapour, or by cough, the extravasated fluid ; these efforts becoming convulsive are not the more useful, but they doubtless discover that an offence is to be removed.

It is, notwithstanding, a proof that the writer saw in the disease before us an hydropic effusion, which could only be removed by the extraordinary energy of the system. The Author of *Zoonomia* countenances the opinion, that an irritation occasions the disorder.

“ Whatever,” says Dr. Erasmus Darwin,*
“ may be the remote cause of paroxysms of

* *Zoonomia*, Vol. I. Sect. XVIII.

“ Asthma, the immediate cause of the convulsive respiration, whether in the Common Asthma, or what is termed the Convulsive Asthma, which are perhaps only different degrees of the same disease, must be owing to violent voluntary exertions to relieve pain, as in other convulsions; and the increase of irritability to internal stimuli, or of sensibility during sleep, must occasion them to commence at this time.”*

The muscles subservient to respiration have been said by anatomists to be in some

* In the second volume of *Zoonomia*, the author modifies the assertion in the former, and thinks the Humoral and Convulsive Asthma differ essentially from each other: a distinction, however, which had so long escaped his observation, seems not to be very firmly established. In fact, the absence of mucus in some fits of the Asthma, or the access of the disorder not occurring at the usual periods, or at the customary hours, can scarcely ever be traced to two regular deviations; and it is acknowledged, that the humoral and convulsive are so intimately blended, as to make the task of finding a different cause for each much more embarrassing than that of assigning presumptive evidence of natural laws as the reason of the occasional absence of one or more of the common phenomena. But though Dr. Darwin retires from his opinion of the probable cause of both being the same, as consisting in a fluid to be absorbed, he still gives his assent to the principle of some pain, to be relieved in the lungs or some distant part; and finally, the distinction appears only to rest on the choice of a sensorial power most adapted to excite the phenomena.

measure influenced by volition, and on this account they have long since distinguished them as having a mixed motion, that is, partly voluntary, partly involuntary. From a consideration of the natural influence which excites them being constituted of two powers, it will readily occur, that respiration will be performed in the most perfect manner when neither of these powers is deficient, and that in proportion as one is feeble, the function will be served with less energy of action. The powers alluded to are those of volition and irritation, which physiologists must have had in view, however indistinct the perception of their operations may have been, before that luminous body which has informed and directed the students of nature, was given to science and futurity by the author of *Zoonomia*.

The paroxysm of Asthma makes its attack, says Floyer, about two o'clock in the morning, when the chyle is most plentiful in the blood.

According to Dr. Withers,* “ the reason why the fits so often occur first in the night, is thought to be owing to the

* Dr. Withers's Treatise on the Asthma, p. 6.

“ heat of the bed, and the horizontal posture in which the patient lies.” There is something indistinct in both these explanations, which seem not to apply with very close precision to the theories which those authors espoused.

It is of more importance to say, that it makes its attack after the patient has been absorbed in sleep, rendered heavy, if not composed, by the condition which in dyspepsia is so ready to communicate torpor from the stomach to the head; and when, by the delay in the passage of the blood from the right to the left ventricle of the heart, the vessels of the head are affected with local plethora and distention. Under these circumstances, volition being suspended, irritation is to perform the whole duty. Effusion of serum in the vesiculæ of the lungs had previously taken place, and from the condition of the pulmonary vessels must be rapidly increasing. If respiratory action is now diminished, that moment when the oppression of the accumulated fluid can be no longer borne will be accelerated, because less vapour will be exhaled in expiration, and the absorbing vessels will be inadequate to re-

move the inconvenience by their power alone.

When this period arrives, those extraordinary efforts commence which constitute the paroxysm of Asthma, and are the *nisus* of nature to relieve herself of pain.

It appears, therefore, that the material will be increased by flumber, and create more embarrassment in the lungs as its bulk extends; but Providence has established other checks to impede the progress of disease in the time of sleep. Volition being suspended, the powers of sensation and irritation are more active. “ Our irritability
“ to internal stimuli, and our sensibility to
“ pain or pleasure, is not only greater in
“ sleep, but increases as our sleep is pro-
“ longed.”*

Volition then having ceased to excite respiratory action, the effect of accumulated fluid is felt with increased sensation, and increased irritation; and those two powers of the sensorium are so active, as speedily to excite the dormant influence of volition. The patient is roused by their combination, and sustains the violence of convulsive respiration.

* Zoonomia, Vol. I. Sect. XVIII.

Volition evinces its power in this disease by protracting the interval between the fits, which may be avoided by active attention of the senses when the serum is not yet accumulated to such a bulk as to be insupportable. The same power is exhibited in Epilepsy as in Asthma. A young man has been affected with Epilepsy from the age of thirteen to nineteen: it most frequently makes its attack in his sleep, but before his senses are gone he perceives the sudden invasion. If his sleep is profound, and the head affected in the very first instance, he cannot stop its progress, though he has a confused sense of his situation; but sometimes he has sufficient warning by numbness in his right hand, a tingling, or a pain, and in this case he starts from his imperfect slumber, and using exertion of his muscles, with attention of mind, he can succeed in stopping the fit, even after the attack is begun. This instance of Epilepsy is marked with irritation in the stomach; a load of viscid phlegm is perceived to oppress that organ, and strong emetics have occasioned its evacuation in large quantities, with temporary relief.

Sir John Floyer could protract his fit by denying himself rest. “* I have found that

* Treatise on the Asthma, p. 94.

“ by late sitting up I have put by the fit for
“ a night or two ; and I have found it com-
“ monly necessary to rise out of bed, espe-
“ cially in the summer time, and to sleep in
“ a chair the first night of the fit. Two
“ nights before the fit Asthmatics want sleep
“ frequently.” The fit threatens to take
place two or three nights before the attack,
and the power of volition is excited to pre-
vent it, which, until the cause has pro-
ceeded to its *acmé* of strength, is equal to
the task, at the expence of sleepless nights.

But the paroxysm does not always come
on in sleep, for after frequent attacks of the
disorder, a period of return is introduced
into the habit, which becomes part of its
œconomy, and is too powerful to be coun-
teracted by preserving to volition all its acti-
vity. Here the same force of habit operates
which influences the disorders of the body
in other instances, even after the cause
which first excited them is entirely removed.
This consideration should have induced the
learned Dr. Darwin to have adhered to the
opinion expressed in the passage above quoted.

The *Aqueous Diabetes* is to be attributed
very generally to the diathesis which is esta-

blished in the habit. In this diathesis a weakness of the solids, and a watery condition of the blood, sufficiently mark the the symptoms as an hydropic effusion from the exhalents of the kidneys, accompanying a similar effusion from the exhalents of the lungs.

It appears also that the arterial exhalents of the kidneys may be relaxed by the sudden impression of passions of the mind, as is usually the case in Hysterical Asthma.

This discharge of pale water, in the opinion of Floyer, is owing to the constriction of the lymphatics which ought to carry off the remaining serum; but there appears such a profusion in a given time, as only to be explained by an excess of water from the arterial capillaries, which pour out their contents faster than the absorbents can take up their portion, and the morbid dilatation of the exhalents must be altered, as is the case in the progress of the paroxysm, before the balance is restored, and healthy urine is discharged from the bladder, and in moderate quantity; frequently indeed, from a natural excess of energy in the absorbents to finish an extraordinary work, in less quan-

tity than is usual; the urinary fæces having less than ordinary dilution.

The tendency to discharge copiously watery urine, accompanies more or less all the varieties of Asthma which make their attack periodically. The kidneys receive nerves from the intercostals, and thus far we are led to a supposition of strong association of motion in the kidneys, stomach, and lungs.

Speaking of Chronic Diabetes, Dr. Ferriar says, “ in the cases which I have seen, “ dyspeptic symptoms have always preceded “ this disorder;”^{*} and Sydenham[†] had regarded diabetes as dependant on a dyspeptic condition, and an impoverished state of the blood.

Dyspepsia, whether it attend Hysteria or Asthma, or both, seems to be still intimately connected with the temporary Diabetes, because this symptom may be frequently observed to take place when flatulence or glut-tony distends the stomach, independent of either of those diseases. This may partly be accounted for from the state of the stomach, which, distended to a great bulk, compresses

^{*} Med. Hist. & Reflections, Vol. II. p. 53.

[†] Sydenhemi Epistola, Responsoria I. p. 271.

the vessels bringing back blood from the lower viscera to the heart; the emulgents will then find a difficulty in forwarding their contents by the corresponding veins, and must relieve themselves by opening a passage for their serum into the urinary cavities of the kidneys. The oftener this necessity occurs the readier will be the exit, and more resorted to by the animal œconomy as an habitual mode of relief.

Mr. Cruikshank* points out a species of Dropsy explaining very sufficiently the pathology of this Diabetes: “ When the arteries find a great resistance to their throwing their blood into the veins, they are obliged to relieve themselves by an increased secretion from their exhalents.”

Dr. Saunders† takes a more extensive view of hydropic effusions from this cause.

“ If a principal vein is compressed and the artery is free, the veins below the pressed part become distended, the limb is enlarged, and œdema follows: because, by the pressure, resistance was formed to

* Anatomy of the Absorb. Vessels, p. 116, 117.

† Treatise on the Structure, Œconomy, &c. of the Liver, 2d Edit.

“ the action of the arteries. The arteries
“ use greater exertion to overcome the re-
“ sistance, but as the exhalents are part of
“ their system, they partake of the general
“ effect, and an effusion of their watery
“ contents follows.”

The discharge of watery urine does not appear to afford relief to the lungs in the paroxysm of Asthma. If this Diabetes was useful, it would still confirm the pathology of Asthma here delivered, as it would point out the absorption of serum in the cells of the lungs, which, as in other hydropic cases, is discharged into the bladder.

Anasarca admits of periodical relief during the night, when irritability is increased, absorption is powerfully excited, and water is hastily determined to the kidneys. It may therefore be allowed, that a similar absorption may be excited in Asthma, and the effused fluid thus withdrawn from the vesiculæ may be carried to the kidneys in extraordinary quantity. But neither is this Diabetes confined to the night, nor does it in fact apparently alleviate the labour of respiration; it seems, on the contrary, to precede or accompany the effusion into the vesiculæ, instead of following it. It continues

whilst the accessions of the disorder last, and it is reduced to a healthy standard when they finally cease, and when it may be supposed the balance between exhalation and absorption is generally, as well as locally, restored. Various considerations present themselves to induce a conviction of this being the true pathology of the Asthmatic Diabetes.

The hydropic diathesis cannot be concealed in the advanced state of the Asthma, for by the testimony of every medical authority it terminates very frequently in anasarca.

Anasarca, in its commencement, is attended with great discharges of water; and before that species of Dropsy comes to be suspected, the exhalents of the kidneys permit the passage of great quantities of water, which for some time may suspend a deposition of it in the cellular membrane, or cavities of the body. Thus does Asthma connect itself with Dropsy by this intermediate link, as well as by the effusion into the vesiculæ of the lungs; and the obsolete term of *Hydrops ad Matulam* seems well appropriated to the aqueous effusion now called Diabetes.

Though this affection in Asthma is temporary as a symptom of the disorder, the frequent recurrence of the complaint, and a degenerated condition of the fluids of the body, have often made it permanently distressing, and by the testimony of M. Sauvage induced a true Diabetes.

The *Straitness of the Breast* not only arises from the mechanical obstacle to a full inspiration of air, and the internal action of the bronchia suppressed in expiration, by the serum effused; but the sense of uneasiness which has acquired this term must be aggravated in proportion as the extent of a close application of oxygen to the pulmonary vessels is diminished. M. Lavoisier proves, that of the oxygen which disappears in respiration *four-fifths* are consumed by a combination with the carbon of the blood, forming carbonic acid gas; the remaining *fifth* is either absorbed by the blood, or uniting with hydrogen discharged from the blood, forms aqueous vapour.

Dr. Crawford* shews, that this component part of the atmosphere furnishes heat

* Exper. and Observations, &c. p. 355.

to the animal system. The comparative heat of florid arterial blood is to that of venous as eleven and half to ten. "Hence," says this Philosopher, "as the blood returned by the pulmonary vein to the heart has the quantity of its absolute heat increased, it must have acquired it in its passage through the lungs. A quantity of absolute heat is therefore separated from the air in respiration, and absorbed by the blood." The manner in which the operation of absorbing heat takes place, is subject to the laws of chemical elective attraction. "The pure air is received into the lungs, containing a great quantity of elementary fire; the blood is returned from the extremities, impregnated with the inflammable principle; the attraction of pure air to the latter principle is greater than that of the blood: this principle will therefore leave the blood to combine with the air; by this combination the air is obliged to deposit a part of its elementary fire, and as the capacity of the blood is at the same moment increased, it will instantly absorb that portion of fire which had been detached from the air."*

* Dr. Crawford's Exper. &c. p. 362.

It is now beyond a question that a principal duty of respiration is to impart heat to the blood, and to furnish it with the quality which oxygen possesses of stimulating the heart and arteries to more vigorous contractions. It will therefore be sufficiently plain, that anxiety of the præcordia, and uneasiness from stricture of the breast, may be increased or alleviated as this principle is more or less closely applied to the internal surface of the air cavities, through the texture of which it is imbibed: hence the Asthmatic eagerly desires an open exposure, and a change of air, because the more air is changed in a given time, the more oxygen is absorbed, and the greater vigour is produced. But the condition of the vesiculæ does not facilitate the operation, filled more or less with serum, that precludes the ready combination of this animating principle with the blood.

Dr. Goodwin proves by his experiments how necessary respiration is in producing that quality of the blood by which it becomes capable of exciting the contractions of the heart; and he still further discovers, that a fluid in the air cells, introduced by the act of drowning, is an important obstacle to the union of pure air with the blood, and fre-

quently prevents the reception of its stimulus, by the efficacy of which the contractions were to be restored. This inconvenience was to be removed, in his opinion, before animation could, in some cases, be secured. He says, “ sometimes there is water insinuated “ into the small branches of the trachea, and “ into the air cells. If the lungs are inflated in this state, the water will occupy “ those places where the fresh air is principally required; and although the lungs “ be inflated with the utmost care and attention, it may be impossible, on this “ account, to apply the fresh air sufficiently “ near the sinus venosus and left auricle, “ to change the quality of the blood they “ contain: the water is therefore to be first “ removed.” In a note he adds, “ this “ opinion is verified in some young animals, where the lungs contained a considerable quantity of froth after submersion: “ if I inflated them fully in this state, the “ colour of the blood in the sinus venosus “ and left auricle was not apparently “ changed, and the heart did not renew “ its contractions, although it still retained “ the faculty of contraction, &c.”*

* Dr. Goodwin, Connection of Life with Respiration, Sect. VII.

We have therefore the authority of experiment to support the opinion which has been here delivered on the cause of some of the most remarkable symptoms which distinguish the paroxysm of Asthma. The accumulation of serum in the air cavities of the lungs may be productive, in its simple mechanical bulk, of uneasy sensation, by taking the place of a finer fluid adapted to the organ: but considering its influence more comprehensively, it may be the cause of a deficient excitement of the contractions of the heart; the blood will then stagnate with greater delay in the ventricles and pulmonary vessels, but more particularly in the right ventricle, because the current through those vessels is rendered slow and difficult by external compression; hence *Polypi* have so often been discovered in the cavities of the heart and large vessels of asthmatic subjects.* The patient may, from this condition, be affected with *Syncope*, and *Irregularity of Pulse*. The irritability of the heart being unequally excited, at one time its action may be languid, because the blood has lost its stimulating property; and occasionally its contractions may be energetic and

* See Part I. Sect. III. p. 40.

strong, because its cavities feel the excitement of uncommon distention. Thus sensations of straitness and anxiety may severally or jointly be produced, and other subordinate symptoms may be satisfactorily explained.

The *Coldness* of the lower limbs proceeds from the deficiency of animal heat; and the *irritability* of the mind from the anxiety of the præcordia.

The *Intermitting Pulse* which Floyer attributes to the constriction of the arteries, from the action of the circumvolving nerves, may naturally proceed from the condition of the heart, which, if not deprived of its principle of irritability, as is asserted by Girtanner, must however sensibly feel the want of stimulus in the quality of the blood. This symptom may be also occasioned by inferior causes, comprehended in the pathology of Asthma. The dyspeptic flatulence of the stomach impeding a full expansion of the lungs, mechanically obstructs the free passage of the blood through them, and of course deprives their extensive surface of the full application of the air by which oxygen becomes united to the blood.

There is an acknowledged sympathy between the stomach and the heart, but Dr. Darwin explains it as follows :

“ The association, or sympathy of motions between those of the stomach and those of the heart, are evinced in many diseases. First, many people are occasionally affected with an intermission of their pulse for a few days, which then ceases again. In this case there is a stop of the motion of the heart, and at the same time a tendency to eructation from the stomach. As soon as the patient feels a tendency to the intermission of the motion of his heart, if he voluntarily brings up wind from his stomach, the stop of the heart does not occur. From hence I conclude, that the stop of digestion is the primary disease ; and that air is instantly generated from the aliment which begins to ferment, if the digestive process is impeded for a moment. The stop of the heart is in consequence of association of the motions of these viscera ; but if the little air which is instantly generated during the temporary torpor of the stomach, be evacuated, the digestion

“ recommences, and the temporary torpor of
“ the heart does not follow.”*

The pathology of Dr. Darwin is doubtless founded upon the most attentive observation, but after the experiments of Dr. Goodwin, which convincingly prove the influence of oxygenated blood on the contractions of the heart, the torpor of that organ may very consistently be attributed to the occasional deficiency of a vital stimulus in Asthma, when the stomach is so disturbed with flatulence as to impede the descent of the diaphragm, and when, in addition to dyspepsia, the internal condition of the lungs is adverse to the application of atmospheric air, and the combination of oxygen with the pulmonary blood.

If we attribute the correspondence between these organs to the intervention of nerves, the difficulty is increased by considering the insensibility of the heart to every stimulus but that of the blood possessing its healthy qualities. Haller assures us, that the substance of the heart has very few nerves; and M. Behrends allows a still more inconsiderable number, and those of trifling

* Vide Zoonomia, Vol. I. Sect. XXV. also XXIII. 4. and XXXV. I. 4.

magnitude, terminating in the coronary vessels.

Spitting of *Black Mucus* is a symptom often occurring, but not invariably, in Asthma, as well as in the pituitous consumption.

Amongst the signs affording a prognostic of Consumption, Morton places the expectoration of black and viscid phlegm in a morning. He tells us, that it proceeds from the glands near the windpipe being filled with a black humour, a symptom common to scrophulous and scorbutic subjects, and indicating a probable consequence of an Asthmatic Consumption.*

But these glands have not been discovered to communicate with the cavities of the windpipe or bronchia, and the mucus is therefore not coloured by an effusion of their contents.

Yet they have been found, upon dissection, filled with black matter. By the testimony of Morgagni, in three bodies out of four which he examined with this object in view, the black colour was diffused through the glands, and paper being rubbed

* Phthisiolog. Lib. II. Cap. II. 10.

over the dissected portions, it assumed a footy tincture, not different from powdered charcoal diluted with a good deal of water.

He however denies, that the black mucus which is said to be expectorated in certain cases can have had a natural excretion into the trachea or bronchia, from these glands, but allows, that erosion in disease may possibly have opened a passage.*

There is, therefore, an expectoration of black mucus, which could have no other source than the capillary exhalents of the vesicles, or glandules of the membrane of the trachea and bronchia, which open into those air pipes; and there is also a similar black appearance in the bronchial glands which are not connected with the air cavities. It is also observable, that by Morton's testimony scorbutic habits are very liable to the symptom, and that it leads to Asthmatic Phthisis.

Dr. Willis remarked, that some patients had frequently in the day, but particularly in the morning, “Sputum instar atramenti
“nigricans.”†

* Morgagni de Causis et Sedibus, Epist. XXII. Art. 21.

† Willis Opera, Vol. II. de Phthisi Pulmonali, p. 49.

Floyer* describes this symptom as belonging to the Hysterical Asthma, as well as to the Periodic, and as giving the appearance of feathers; and Dr. Withers had observed it in many cases.†

I have frequently remarked an expectoration of black mucus in Asthmatics, when there could be no suspicion of the rupture of any small vessels. I believe the material which colours the mucus is the carbon of the blood, which in the healthy state of the system was exhaled in carbonic acid, the atmospheric air having been then properly decomposed. The exhalent orifices of the pulmonary artery have been shewn to be morbidly dilated, and instead of exhaling vapour, permit the escape of a condensed liquid.

The habit of an Asthmatic is generally distinguished by cold extremities, and a blue skin; the former almost always prevailing, the latter frequently. Dyspepsia is accompanied with watery blood, and weak contractions of the muscles. A predisposition is exhibited in these circumstances favourable

* Treatise on the Asthma, p. 11—19.

† Withers's Treatise, &c. p. 8.

to the opinion of Dr. Beddoes, that in Asthma the system is invigorated with too small a proportion of oxygen.

When the accumulation of serum produces the paroxysm, it will also prevent the ready absorption of oxygen by the blood. The heat of the lungs in Asthma is below a healthy standard, and a certain temperature is requisite to promote the chemical process of oxygenating the blood, and imparting heat to the system.

The predisposition, therefore, of the body being cold, the blood will be more phlogisticated, and have more carbon to discharge in respiration, even when the accumulation of serum has not yet produced the paroxysm of Asthma.

Dr. Priestley had proved, that the livid colour of the blood in the veins depended upon its union with the inflammable principle; and it is possible to consider, in the predisposition to Asthma, a condition of the arterial blood approaching too much to the character of venous blood described by that Philosopher: for the coldness and torpor of the habit may certainly have long continued to injure the oxygenation of that fluid.

“ When an animal,” says Dr. Crauford,
“ is placed in a cold medium, the venous
“ blood assumes a much darker hue than
“ when it is placed in a warm medium.

“ Admitting that the sensible heat of
“ animals depends upon the separation of
“ absolute heat from the blood, by means of
“ its union with the phlogistic principle in
“ the minute vessels, may there not be a cer-
“ tain temperature, at which that fluid is
“ no longer capable of combining with
“ phlogiston, and at which it must of course
“ cease to give off heat?

“ The air expired from the lungs of an
“ animal is more phlogisticated in a cold
“ than a warm medium.”*

This ingenious Philosopher concludes
from his experiments, that “ when an ani-
“ mal is placed in a warm medium, the
“ colour of the venous blood approaches
“ more nearly to that of the arterial, than
“ when it is placed in a cold medium; the
“ quantity of respirable air, which the ani-
“ mal phlogisticates in a given time, in the
“ former instance, is less than that which it
“ phlogisticates, during an equal space of
“ time, in the latter; and the quantity of

* Exper. and Observat. p. 311.

“ heat produced, when a given portion of
“ pure air is altered by the respiration of an
“ animal, is nearly equal to that which is
“ produced when the same quantity of air is
“ altered by the combustion of wax or char-
“ coal.”*

The inferences from the above facts are, that by whatever means the predisposition to Asthma may be acquired, it is chiefly characterised by a low temperature, weak solids, and watery fluids; in other words, hydrogen holding carbon in solution predominates in the system, and gives to the arterial too much of the colour and quality of venous blood.

In healthy respiration the oxygen having a stronger attraction to the carbon of the blood than to the other components of atmospheric air, is absorbed through the soft and vascular membrane of the air cells, and combines with carbon, to be exhaled as carbonic acid in expiration; but if the air cells are obstructed with serous fluid, the oxygen cannot be attracted to enter into this new combination, because the atmospheric air cannot be inspired to the requisite depth,

* Exper. and Observat. p. 352.

and come closely into contact with the membrane, through the texture of which the union is accomplished: the carbon must therefore remain in the blood in greater quantity than was usual, and an extraordinary portion will be involved in the serum effused by the capillary exhalents; and in this condensed form, and without the aid of a healthy temperature, the process of oxygenation and discharge of carbonic acid cannot take place; but the expectorated phlegm shews more or less of the excrementitious matter of the blood in the appearance of black mucus. The mucus is also streaked, or bears the appearance of feathers, from the carbon colouring it in the pipes of the lungs, and the mucus carrying the impression of these molds as it becomes thickened, these lines of black being connected with a serum less deeply carbonated, and descending to fill their intervals.

An expectoration of this quality can only be supposed when a very considerable extent of the vesicular surfaces is covered from the contact of air by a coat of serum; but the predisposition of the blood, which leads to the Pituitous Consumption as well as Asthma, may at all times favour the appearance;

and, according to the testimony of Morton and Willis, the effect occasionally takes place in both. The species of Consumption called *pituitous*, is, in fact, a case in which there are contra-indications, and in its commencement will not allow a certain prognostic of which disease it may finally bear the character ; of Asthma or Phthisis.

If the mucus is not black, it may be pellucid, or yellow, according as it is digested, or has remained in the follicles of the trachea or vesicles more or less time previous to the discharge. If it is tinged with blood, it is apparent that the capillary apertures are so dilated as to permit red globules to pass. In cases where this appearance occurs, there is more force in the contractions of the arteries than common : I have also observed the pulse to be from eighty-six to ninety-six, and the exciting causes were violent exercise, with a bound belly ; but even here I saw no advantage from blood being taken away, as the symptom did not remit sooner than the patient, who was an experienced Asthmatic, had formerly known. Mucus of a saltish or sweetish taste has had minute portions of blood in the mass, and undergone more heat

than generally prevails in the lungs of Asthmatics; and it is probable that expectoration of this quality proceeds chiefly from the excretory follicles of the trachea, in which some catarrhal inflammation had been united to the general symptoms.

Sleepiness comes on sitting, but not leaning backwards, according to Floyer. This is in the *acmé* of the paroxysm, when the oppression of the fluid is most considerable, and an erect posture absolutely necessary to respiration. In this state a reclining posture would give additional embarrassment to the process of inspiring air, because the stomach and lower viscera would press more against the diaphragm than when in their depending situation.

The necessity of an erect attitude is also to be accounted for by the obstruction to the passage of the blood through the pulmonary artery occasioning a plenitude and delay in the right ventricle, and in course an opposition to the free entrance of venous blood from all parts of the body into the heart: but if the cavities of the ventricle and pulmonary vessels are so much lessened or occupied, a reclining posture, by impelling the

Difficulty of Breathing -
Cough -
Rapid Respiration -
Expectoration of Mucous -
The Remissions -
The Access - Anxiety -
The Signs of a New Stage -
The End -

circulation towards the heart, must increase the anxiety, the straitness, and the suffocative sensation occasioned by the obstruction at present subsisting; sleep will therefore be more opposed by the exertions of volition to preserve respiration and life, than it will be promoted by the fullness of the veins of the head, the dyspepsia of the stomach, and the debility and the languor of the habit; all these causes may indeed concur to produce the symptom of lethargy, but a more powerful instinct to preserve life in the extremity of the disorder averts their effect.

The *Pulse* of an Asthmatic is generally feeble; as the fit approaches a temporary increase of fulness and strength may be occasionally perceived in young subjects; but the indication is not to be depended upon, for in the progress of the paroxysm the symptom vanishes, and weakness succeeds, with frequency, but the pulsations seldom exceed ninety in a minute.

When the pulse is most frequent the mouth is moist, and there is often a whitish mucus upon the surface of the tongue. Thirst seldom attends, either in the paroxysm or in the intermission.

The *Urine* is very pale and copious before the fit, and during its progress; it is also frequently copious and pale without the fit coming on, but attending on occasional indigestions, to which the Asthmatic is for ever liable. When the fit goes off there is no remarkable deposition in the urine, but it is muddy, and generally in less quantity than is natural to health. If the urine is copious and pale, it is, I believe, never sweet. I have tasted the water of an Asthmatic more than once, when the circumstance of quantity and appearance strongly solicited my curiosity, but I always found it weak, saline, and of no saccharine taste whatever.

The *Belly* of an Asthmatic is not often regular; when it has been regular by custom I have generally found that it was lax. If the Asthmatic is bound in his body, it probably induces a fit; but this state generally alternates with diarrhoea, and both may be accounted for by the dyspepsia of the first passages.

There is at the access of the fit a remarkable action of the abdominal muscles, and of

all the muscles which are in common use for the discharge of fæces, and the exercise of respiration. The Asthmatic finds it impossible to resist the impulse, and before he has much experience he flatters himself, that the evacuation will be followed by relief. Circumstances may be so favourable as to confirm his hopes; but I have very seldom seen this fortunate occurrence. The effort to expel the contents of the bowels may be excited by their acrimony; but the muscles which are subservient to the discharge have so often been employed in respiratory action to relieve the lungs of irritation, that, whether the irritating cause is in the first passages, the lower bowels, or the lungs, the sudden invasion of their efforts may be excited by distress of one of these organs, and it may not be distinctly known in which the cause resides; the result may, however, shew, that all these cavities have been offended, that only the stomach and bowels have been irritated, and the fit may be short; or that the vesiculæ have been chiefly oppressed; and then the fit proceeds in a more regular manner, and terminates with expectoration of mucus to great certainty,

It has been observed, that an obscure sense of heat is perceived sometimes in the paroxysm, pervading mostly the trunk of the body; but the temperature is, notwithstanding, low, nor does this perception so often occur as that of coldness.

The *Habit* of an Asthmatic is generally cold, with the occasional exception of a short interval in the access, when there is an increase of effort in the arterial circulation, which does not continue long. Some exciting causes may likewise occur to raise the temperature of the body; and Dyspnoea is not so likely to be marked with this prevailing symptom, as the regular form of Convulsive Asthma.

If the bulb of a thermometer is put into the mouth of an Asthmatic at the approach of a fit, the temperature is observed to be lower than in the intervals. In the height of the fit I have found the heat of the exhaled vapour confined to the cavity of the mouth at eighty-two of Fahrenheit, when the same subject had, the day before, proved the temperature by this test to stand at ninety-seven.

Three hours before the death of an Asthmatic,* the temperature within his mouth

* See Sect. VII. Obs. XVI.

was reduced to seventy-three. I have often applied the thermometer, but have not yet been gratified by knowing with how great a diminution of temperature it may yet be possible for the patient to recover.

If the stomach is full or empty, the inconvenience in the paroxysm is almost equal; at least, nothing can exceed the great distress which the patient feels from a perfect emptiness in that organ, occasionally, after the remission is commenced, and exercise is pursued to any extent. If the stomach is filled in the state of debility which it suffers in the paroxysm, the consequence is sufficiently manifest: the middle road should carefully be pursued.

The Asthmatic may suffer many or few fits in a certain time: Floyer sustained thirty-six in the year; but some must have been of very short continuance, probably excited by indigestion, and relieved as the stomach resumed its healthy function; for it is allowed, that after repeated attacks the habit of convulsive contraction of the abdominal and intercostal muscles will be so confirmed, that

these convulsions may take place from inferior exciting causes.

He observed, that the Periodic Asthma was regular once in ten days, but that the Continued was uncertain. When the paroxysm comes on so frequently as once in ten days, I have usually remarked, that considerable Dyspnoea is permanent between the fits; and it always may be depended upon, that the longer and the more perfect an intermission is, when the genuine Convulsive Asthma is established in the habit, the more violent is the accession of the paroxysm.

The *Mind* of an Asthmatic is impatient, and he suffers much from opposition to his own method of management. After several accessions he has ascertained modes of comfort and satisfaction, which the anxiety of his friends may impede rather than promote, by their sollicitude and attentions: he therefore is irritable, and with difficulty restrains his disposition to petulance. But, excepting in the exhausted habit, vivacity and good humour never fail to return with the freedom of natural respiration.

The *Respirations* in the paroxysm are more numerous in a given time than in health, a fact which stands in direct opposition to the authority of Floyer, and in some measure diminishes the weight of his reputation for accuracy. I have reckoned from twenty to forty respirations in a minute, but they never exceed thirty without a very considerable increase of frequency of pulse, and a well-grounded indication, that the case is complicated with some pneumonic inflammation. In simple Spasmodic Asthma it is, however, remarkable, that the respirations are more frequent than in proportion to the contractions of the heart: it is therefore extraordinary that Floyer should suggest a contrary state, which is not supported by any authority, except that of Zecchius, which he quotes: in opposition to which Willis describes the respiration as "*crebra et anhelosa*;" and Dr. Stark observes, that patients in this disease commonly breathe "*thirty or forty*" times in a minute, and still oftener after "eating, or the most moderate exercise."*

In the advance of hot weather some patients suffer, with great certainty, the in-

* Stark's Works, p. 43.

vation of the disorder. These subjects, it is probable, met with the inconvenience which will always follow an excessive evaporation of fluid: the loss of heat in the vesiculæ would be in proportion to the quantity of exhalation, and a torpor from cold would affect the capillaries opening into these cells; a speedy change in the diameter of the capillary mouths would be induced, and a consequent effusion of condensed liquid. The winter, however, frequently affects the Asthmatic also, but very seldom when the weather is cold and frosty, and when the density and weight of the air is proved by the barometer; coldness and moisture in conjunction are very unfriendly, and seem not only to check perspiration, but to give to the cutaneous vessels an imbibing condition.

Much of the history of this curious disease has been now delivered, and, I hope, enough to elucidate the nature of the cause which immediately occasions a paroxysm. In proceeding with the consideration of the remote causes, the existence of mucous irritation in the vesiculæ may be rendered still more probable; but after the preceding re-

marks, an endeavour to give new proofs a conspicuous light seems to be unnecessary: my observations on the remote causes will be accepted, by the medical reader, without hesitation, as they comply at once with the experience of physicians, and are naturally connected with serous effusion in the vesiculæ of the lungs.

SECT. XI.

REMOTE CAUSES of CONVULSIVE ASTHMA.

*The Predisposing Causes.—The periods of life.
—The sex.—The temperament of Body.—
Dyspepsia.—Its consequences.—Effect of
Dyspepsia on the circulation and secretions.
—General debility of the solids.—Condition
of the fluids.—Sensibility or irritability of
the habit.—Lymphatic absorption cursorily
considered.—Its importance in the animal
æconomy.*

IN pursuing our inquiry after the remote causes of that serous effusion in the pulmonary vesicles, which has been described in the preceding sections, and which has been stated to be the immediate cause of a paroxysm of Asthma, we find a condition of the body

which is liable to be excited by circumstances internal and external. This is a *Predisposition* to Asthma; and those circumstances which are sometimes internal, but generally occur from without, are *exciting causes* of the fit.

The *Predisposition* is of all the remote causes most important, and claims particular attention.

Hippocrates* attributes to youth a state of habit ready to suffer hæmoptysis, inflammations, and fever; beyond this period the constitution is liable to be attacked by peripneumony, lethargy and Asthma. In advanced age difficulties of breathing, &c. come on, but this writer applies the word *ασθματα* to that constitutional affection which he assigns to manhood in the 30th aphorism, and *δυσπνοια* to that of old age in the 31st. And he also in the 26th aphorism includes *ασθματα* amongst the affections attacking the body in the period before puberty.

The affection signified by *ασθματα* in this place is again attributed to puerile habits in another† by the same word.

* Hippocrat. Fœsli. Aphor. 29, 30, 31. Lib. III. Sect. VII.

† Liber de Aere, Locis et Aquis. Fœsli, Tom. I. p. 281.

Infancy and manhood were therefore esteemed by the father of medicine, the periods of human life predisposing to this disease; old age brings a condition which is naturally less irritable, and therefore the habit is less likely to assume the strong convulsive contractions which may attend the other stages, but it does not follow that the contractions of respiratory muscles are not convulsive in old age; for if difficulties of breathing, or *δυσπνοια* affect the subject, in consequence of excessive moisture offending the lungs, we have no alternative in our construction of the nature of muscular contractions, which are convulsive when they are inordinate, or inconsistent with the common purposes of healthy respiration: nor can difficulty of breathing be characterized precisely in any other manner, than by the measure of contractions which these muscles undergo; though it may be allowed that a particular energy, which is not often to be expected in old age, is essential to the character of the Convulsive Asthma of Modern Nosology, which, in this instance, is supported by the authority of the Greek Physician.

Men are said by many writers to be more generally affected with this disease than

women, which may probably be the case, because the female sex are not so much exposed to the application of exciting causes.

The *Temperament* which predisposes to Asthma is the *choleric*, but it seems to derive its principal power in affecting the pulmonary function, from the disorders of the first passages to which it is liable, and to the combination of muscular relaxation with the peculiar character of its own habit.

This habit is accompanied with *Dyspepsia* very frequently, as well as the melancholic, from which it may possibly be too great a refinement in practice to separate it, though the learned accuracy of Dr. Gregory has well marked a distinction.*

Persons of this temperament are more subject to accumulations of blood in the pulmonary vessels, and to be affected by sudden impulses of passion and emotion of mind, which readily occasion an impetus in the circulation, overpowering the contractile tone of the exhalents. They are also affected with too active a secretion of bile, which may occasion new irritation and heat at the præcordia, as it certainly is frequently the effect

* *Conspectus Medicinæ Theoreticæ*, 929.

of high passions and a luxurious life. If to this state is super-added Dyspepsia, from want of exercise and indulgence at the table, or from the use of a contrary diet, consisting of aliment too weak and fluid, the choleric temperament will be more influenced by the exciting causes of Asthma than any other, and may be more generally observed to be subject to its attacks.

Wherever Dyspepsia prevails, there shall we find a fruitful opportunity of exciting the paroxysm of Asthma; but this morbid debility of the stomach must probably concur with accidental causes before the disease appears.

After it has long had possession of the first passages, the proper nourishment of the body must be considerably impeded, and the solids being weak, the fluids must be watery and poor. The temperature of the habit is then low in both, and unfriendly to the promotion of new chemical affinities, by which oxygen and heat is imparted to the system. A morbid state is then productive of new disorder, or it may be said, that predisposition is more confirmed, and more rapidly approaches the point to which it tends.

The stimulus of the blood will not excite the heart and arteries to vigorous action, the exhalents will not contract with healthy irritability, and an over proportion of water in the blood will make the exit of serum through their orifices more easy and copious.

Dyspepsia is acknowledged to be a frequent cause of Hydropic Diathesis; and the effusion of serum into the vesiculæ of the lungs is probably preceded or followed by other dropical effusions, which have so frequently been mixed with Asthma in histories of Anasarca.

There besides arises a mechanical effect from this relaxed state of the first passages, which, by impeding respiration, very nearly and suddenly induces the proximate cause of Asthma. The stomach may be distended to fill a very considerable space, which should be allotted in inspiration to the descent of the diaphragm: at the moment when that muscle is excited to contract its fibres and become plane, that the vesiculæ of the lungs may be inflated with new air, the bulk of the stomach presents an obstacle to the exercise of this function. The progress of the blood to the left side of the heart is delayed in the pulmonary vein. The capillary orifices of

the artery are dilated to relieve the turgescence of the branches of that vessel, and a critical escape of serous fluid ensues. This occurs in vessels which have coats not thin and tender, which predisposes to Phthisis, but relaxed and dilatable, which is part of the predisposition to Asthma.

By this distention a more extensive inconvenience follows, of the same kind; other vessels are probably compressed, and, as has been explained, the Aqueous Diabetes is produced. The duodenum is part of the first passages, and partaking of the debility and disorders of the stomach, must always be included in considerations of the influence and pathology of Dyspepsia;* and more remotely the whole canal suffers from the vices of the first digestion.

The motion of the blood is promoted both in the arteries, and in the veins, by the action of contiguous muscles. The blood returning to the heart by the Vena Cava, and its branches is moved by the action of the heart and arteries, and also by the contraction of muscles which press the veins. Pressure from these causes, and subject by the

* Vide Hoffman de Duodeno Multorum Malorum Causa, Tom. IV. p. 188.

rules of muscular contraction to alternate relaxation, must determine the blood towards the heart, because these veins are supplied with valves which forbid its progress in the contrary direction.

The lymphatic vessels more numerously provided with valves have their action increased by the same causes. When, therefore, we consider the deficient energy of the heart and arteries, and the irregular contraction of the visceral muscles, in Dyspeptic patients, we must allow a very fruitful cause for a slow progress of blood in the returning veins, and the consequent turgescence of the arteries which secrete the urine, or, more precisely speaking, which permit the thinner part of their contents to pass off in quantities proportioned to the necessity of relief.

The Vena Cava passing through the Diaphragm, the free motion of that muscle materially influences the return of the blood to the heart, and the circulation being impeded in the liver, from the languor of the vessels which are to carry off the blood, hydropic effusions may follow* in other cavities besides those of the lungs; accordingly we observe

* Vid. Hoffman, Tom. III. sect. II. cap. II. p. 98. necnon, Tom. iv. Conf. et Resp. Med. Cent. 1. Casus XCIII.

dropfy of the belly and cellular membrane to follow Afthma from this mechanical caufe, as well as from others that are well known.

This Dyspeptic ftate of the ftomach is fo combined with the immediate caufe of Afthma in a great majority of cafes, that it is difficult to feparate it, as a predifpofition or fymptom of the difeafe in confidering all. Whatever reasoning may be adopted on the diftinctions of fpafmodic, humid, or hysteric, it will be found that none of thefe fpecies is clearly unconnected with flatulence, which, without any certain exception, makes part of the paroxyfm, or precedes it.

But though Afthma fo feldom appears without Dyspepfia, the latter affection frequently occurs in practice unconnected with Afthma. Sir J. Floyer confiders this ftate of the ftomach as fecondary to the ftate of the lungs, and not as an occasional caufe. The powers of digeftion will certainly be additionally weakened whenever the habit which fettles in Afthma is formed, and in this view Dyspepfia may follow Afthma, but it has previoufly been a caufe of the difeafe, which reciprocally occafions an encreafed debility of the ftomach, and is itfelf exafperated and excited into exacerbations by it.

He remarks, notwithstanding this opinion, that “ a short fit is accompanied only with
“ wind and spitting, and depending on dis-
“ orders in diet, &c. and this was his Asth-
“ ma before it settled into periods.”*

It is to be suspected that the tyranny of 30 years under which he suffered, was established by an improper application of remedies to restrain the first approaches. It may be also inferred from his reasoning, on the necessity of fermentation in the stomach, that he had remarked the strong prevalence of dyspeptic symptoms in general cases of Asthma; but such reasoning is now superseded, and we know that if the stomach is not morbidly feeble it will be able to govern the food, and pass it on before the process of fermentation can take place.

The character of his disorder may be seen in the following passage, which is quite sufficient to prove the dyspeptic malady to those who can comprehend his meaning: “ Fla-
“ tulent Lympha evacuated into the stomach
“ and guts, raising the alimentary mass there
“ into violent flatulencies, like wine over-
“ stummed, the glands of the trachea and
“ vesiculæ of the lungs receive part of the

* Floyer, p. 12.

“ mucilaginous, flatulent, nutritious juice,
“ separated from the blood by the effervescence,
“ &c.” It is obvious that he was disposed to confound all the symptoms, and that he saw obscurely an accumulation of lymph in the lungs, and was convinced of indigestion and flatus in the stomach, but injudiciously blended into one false theory the distinct affections.

The Œsophagus was found by Dr. Hales, very dilatable with a small force of water or wind,* which leads to a conclusion that dyspepsia may frequently distend the whole canal, and that it may be productive of wheezing where there is no obstructing mucus in the air passages sufficient to account for that symptom. Flatulence may force the sides of the Œsophagus against the trachea, compressing the cavity of that pipe into a smaller area.

Hales attributes the vertigo of dyspeptic patients to the occasional cause of flatulent wind in the Œsophagus, compressing the descending aorta, and by this means, impelling the blood for the instant towards the head.

* Statical Essays, Vol. 2. p. 183.

The encrease of bulk which an Asthmatic occasionally sustains from his dyspeptic complaint, is very considerable. It will be greater or less according to the aliment which has been taken, some substances containing a greater quantity of fixed air than others; and it is probable that in the exacerbations of the disease, digestion is so very ill performed as to permit the evolution of the whole mass of air combined with the substance. The distention which may take place in such cases may be conjectured, after reflecting on the quantity of air extricated from pounded apples, which give out 48 times their own bulk.* This air in the apples must have been condensed into less than a forty-eighth part of the space it takes up when free from them. Fermentation and heat are the cause of its separation, and these causes must operate after a certain delay in the stomach, from the debility of the organ, and the faults of quality or quantity in the gastric liquor. A light atmosphere suddenly discovered by the falling of quick-silver in the barometer, may add to the influence of these causes by compression on the ingesta being diminished, and the elasticity of the

* Vide Dr. Hales' Vegetable Statics, p. 208.

confined air having less external resistance made to its eruption.

Dyspepsia may be Symptomatic or Idiopathic, but it is obvious that the Idiopathic Dyspepsia is the disease which makes part of the predisposition here assigned to Asthma.—When the affection is symptomatic of Retrocedent or Atonic Gout, Exanthemata, or Ammenorrhæa, it may afford an obstacle to freedom of respiration and circulation whilst it continues, but the hydropic diathesis, the relaxed solids and watery fluids, are not part of the consequences of temporary dyspepsia. The Idiopathic arising from a loss of tone in the muscular fibres of the stomach, may have depraved the digestion for any supposed length of time, and the peculiar debility, in which its own character consists, will be increased in proportion, and extended over the system.

The hydropic diathesis may follow or precede Asthma, and is a condition leading to the effusion in the vesiculæ in common with effusions elsewhere. Dyspepsia induces general debility, and this state is followed by a general laxity of the exhalents, and an increased exhalation into every cavity and interstice of the body. “We have seen,”

says Dr. Cullen, “ effusions of a serous fluid
“ made in the same time into the cavity of the
“ cranium, into that of the thorax and abdo-
“ men, and likewise into the cellular texture
“ almost over the whole body. In such cases
“ the operation of a general cause discovered
“ itself by these several dropsies, increasing
“ in one part as they diminished in another,
“ and this alternately in different parts.”—
He refers such a condition to a general laxity
of exhalents,* and if the effect is not dis-
covered so often in the air cavities of the
lungs as in others, this organ owes its greater
security to the continued and incessant acti-
vity of absorption by lymphatic vessels, and
of respiratory motions which assist absorption,
in removing by vapour the encreasing fluid.
We have a dependence on this combined
power, in proportion to the importance of the
function to be preserved by its efforts.

In the paroxysm the surface of the body
is universally pale, and the muscles appear
shrunken. The weakness of the heart and
arteries, with a predisposition of their con-
tents to the character of venous blood,
because oxygen is deficient, sufficiently ac-

* Cullen's Practice, MDCLVII.

count for both symptoms. And if the Asthmatic in the intervals of his fits preserves the livid complexion, the predisposition of the blood is still to explain the appearance, and to afford prognostic of future accessions, as exciting causes may occur.

In this state of the blood of an Asthmatic, it is not necessary to foresee consequences more fatal than usually occur in the disease. Mr. Kite has proved, “that the left sinus “venosus, auricle and ventricle, do not cease “to contract in consequence of the phlogisticated state of the blood in their cavities.”* In Asthma examples have been given in sect. VII. of different degrees in the intensity of this affection. In some subjects the great effusion was too oppressive to be discharged from a habit of little irritability; in others, life was preserved with difficulty, and the balance had been kept between death and recovery, with terrible uncertainty of which scale would finally ascend. In these instances effusion of serum had been sudden and extensive, excluding the further penetration of oxygen into the vessels, but notwithstanding, life was still preserved, till the irritability of the system being exerted with energy, the bar was removed.

* Mr. Kite's Essays and Observations on the submersion of Animals, &c.

An ingenious writer* very justly objects to the theory of fever, depending on the deficient quantity of oxygen received into the blood by inspiration, because unless this diminished proportion is referred to the peculiar actions of the system of the person afflicted, and to his corporeal mechanism, all persons would be equally affected with fever, whilst the atmosphere, that grand magazine of oxygen, is open to the benefit of all. In such a case the accumulation of Carbon and Hydrogen, with the consequences stated, are to be regarded as effects.

This consideration applied to Asthma very sufficiently confutes a doctrine attributing the disease to the deficiency of oxygen, without reference to those morbid derangements of the animal œconomy, which may impede or embarrass the absorption of this fluid, so useful as a remedy, and whose absence may add to the exciting causes of the phenomena, though it cannot be the proximate cause of their existence.

The Predisposition to Asthma is necessarily marked by a habit from which the sub-

* Dr. Hamilton Obs. on the Seats and Causes of Diseases, Vol. 1. p. 93.

ject is affected, by apparently small impressions on the nerve or fibre, whatever name this disposition may have obtained; Mobility, Irritability, or Sensibility. The robust are unaffected by impulses which the feeble or delicate may acutely feel.

This disposition of the body is likewise more perceptible at one period of life than at another, and certainly is gradually less acute with the progress of years, and becomes almost lost in extreme old age.

It is as well described by the term *Irritability* as any other. It is always marked in its degrees of acuteness by the habit of facility with which convulsive motions, after having been once excited, run into excess, or, which having subsided with their cause, are liable to return, upon much inferior occasions, and even in some instances without a perceptible excitement.

This is a predisposition, without which the spasmodic contractions called Asthma, cannot in some cases be accounted for, and it seems to attend or precede the production of the Convulsive Asthma from mucous irritation. This irritation may be removed, but the predisposition remaining, the disorder cannot be said to be cured.

It may be suggested, that if the state of the pulmonary vesiculæ in Asthma is described with fidelity, a paralytic atony of the *Lymphatic Absorbents* is probably a concurring cause of the accumulated fluid. Such a temporary debility of action in the absorbents is not impossible, but the Pathologist must be unwilling to rely on the frequency of their morbid condition, because Providence has, doubtless, placed them in the animal machine to relieve the disorders which may occur to every other branch of the system.

Mr. Hunter first supported the opinion, that solid as well as fluid bodies may be removed by absorption, and experiments have actually ascertained that this is fact. The energy of this class of vessels is never to be diminished without important injury in the habit, and if disease attacks them, it is only to be alleviated or cured by a fortunate alteration in their own tone. The arterial and venous vessels are not proved to give assistance in any derangement of the lymphatics, though the latter may be corroborated by the same means as strengthen the former, but effusions from those vessels, or new and unnecessary productions from them, are perpetually carried off, and the healthy function of the vessels

themselves restored by the efforts of the lymphatics; and it is probable that no dropfy can be deemed incurable, whilst absorbing action is performed by a perfect organ.

If, then, we are to consider the paralyfis of the lymphatics, as a cause of the accumulated fluid in the vesiculæ, and of the aqueous diabetes which attends it, we must suppose a condition of the absorbing system, which is not likely to admit of the relief which so periodically supervenes upon a paroxysm of Asthma. If we suppose a rupture of a lymphatic branch, we infer a fixed and local cause of continued dropfy; and if a spasmodic constriction is alledged, the case is too uncertain and capricious to be depended upon, and may so commonly occur, as to stand in opposition to the design of the lymphatics, whose office is that of the last guardian of the safety of the animal œconomy. But the relaxed state of the exhalents is perpetually liable, from exciting causes, to give out this excess of fluid, and we have no resource in explaining its diminution or removal in general cases, but the salutary and providential interposition of the power of absorption. How efficacious this power is, the rapid removal of dropfies in some

instances, and of useless bones in others, and of productions which the œconomy of nature declares to be superfluous, or embarrassing to her operations sufficiently evince.

That the absorbing vessels are particularly essential to the preservation of the air cavities of the lungs from obstruction of any kind, must be concluded from their great number dispersed in the pulmonary system. “Next to the liver,” says Mr. Cruikshank, “the greatest number of absorbents has been found in the lungs.”* Dr. Hales says, the velocity of the blood in the lungs, is many times greater than in most other parts of the body. A remora in any of the vessels of this organ, will therefore be in proportion, more productive of uneasiness than in any other; and effusion from the exhalents, or rupture of the vessels, according to the habit of their coats, will be a consequence of a free return of blood from the right side of the heart to the left being obstructed, sooner than in any vessels where the velocity of the blood is less, though those vessels should be equally obstructed, and the number of times when such consequence occurs, must, in these circumstances, correspond with the sum of velocity exceed-

* Anatomy of the Absorbents. p. 196.

ing in these vessels the velocity in any other. Thus in the habit which admits its vessels to be dilated and not ruptured, effusion in the vesicles may perpetually demand the active absorption of the lymphatics of the lungs, and without that natural interference being preserved in undiminished vigour, and more generally so, than a theory of paralytic or constricted lymphatics will support, Asthma must be a disease occurring much oftener than we find it, and much more fatal in its progress and result.

It was therefore designed by Providence that an absorbing vessel should be stimulated into action, by the presence of a fluid at its mouth, which it takes up by selection, rather than by capillary attraction.*

By this wise plan a lymphatic is excited to act in proportion to the quantity of stimulus, which irritates its appetency, and an energy is founded, which, in the pulmonary system, is ready to be exerted for the most important purposes, and is naturally commensurate with the distress which accumulated serum brings upon the organ.

The same astonishing provision for constitutional relief, seems to be attended to in

* Mr. Cruikshank *Aborb. Vessels*, p. 110.

the apparatus of nerves, which is furnished to the absorbing vessels with careful regard to their independent function. These vessels are not to be the sport of every external relation, but to obey the silent laws of animal irritation. Their action is to commence when the heart has propelled the blood, and a continued contraction of the arteries has carried it to the extreme parts of the arterial system. If a diseased vessel gives way to the impulse, the fluid which passes out of the aperture, is drunk up by the lymphatics, and if at the very extremities the exhalent orifices are morbidly relaxed, and permit the serous part to be effused, this also meets the mouths of the lymphatics, and solicits their absorption.

But if nothing morbid occurs in the progress of the blood along the arteries, the veins may not perform their duty in a perfect manner, their sides may dilate, and may become ruptured, or if an obstruction in these vessels is considerable, the arteries not throwing the blood with their usual facility into their cavities, assume a turgid state and relieve themselves by capillary exhalation.

Here is another exciting cause of exertion in the absorbing vessels, which must drink

up the extravasated venous blood, or the arterial lymph, and without a permanent capacity to perform this office, the animal body would be continually subject to derangement. The Supreme Artist, therefore, constructed them with an appetite to be stimulated in measure equal to the irritative cause, but his plan excluded the influence of external sensation in the degree which affects the other vessels, on whose motions this system was designed to wait. “ There is, therefore, “ in the absorbents less dependence on “ nerves, than in the muscles and arteries.”*

When the unobserved activity of this system is reflected upon, and its extensive value to the health of an animal body, it might be almost asserted that the Creator planted in the original fabric of man, one moving power, which was to be the lever which physicians were never to neglect to study in its construction, its relations, and its force; by this, disease was to be removed, when no instrument which human genius could invent, was competent to effect the object, and which was to discover at intervals its magnitude of power, and the ex-

* Mr. Cruikshank's *Anatom. of the Absorb. Vessels.* p. 172,

treme benevolence of the Supreme Architect in giving it to the animal system.

These are considerations which appear to render the supposition of constricted or ruptured lymphatics, being amongst the remote causes of a paroxysm of Asthma, very improbable.

SECT. XII.

The Remote Causes continued.—The Exciting Causes.—Alterations in the density of the air.—Effect of unusual rarity.—Oxygen united to the blood in greater proportion as the pressure of the atmosphere encreases.—The rarity of the air on mountains and elevated countries.—An animal destroyed by exhaustion of air.—An animal exposed to accumulated density of air.—Lightness of air with moisture, and with heat and moisture.—The heat of summer and autumn.—Effect of evaporation, from surfaces.—Cold.—Cold and moisture.—Easterly and northeasterly winds.—Rain, snow, storms.—Active exercise in warm air.—Dissipation of heat.—The asthmatic months of August and September.—Frosty weather.—The advantage of frost.—The cold bath.—Evacuations of blood.—Violent purging or vomiting.—Inanition.—Accelerated impulse of circulation.—Suppression of evacuations.—Repulsion of exanthemata and gout.—Dust in the air.—Metallic fumes.—Smoak of Tobacco.—Smells.—Perfumes.—Fixed air.—Passions of the mind.—Changes of the moon.—Errors in diet.

THE influence of the state of the air, upon a nation or body of men, may not be produc-

tive of any evident effects upon their corporal habits, generally considered ;* but changes of the atmosphere will incontrovertibly induce alterations in the health of subjects predisposed to particular diseases, and by these changes they may suffer exacerbations, or be restored from their violence, and enjoy remissions. In all diseases of disordered respiration, whether febrile or not, this truth is confirmed by experience. In *pertussis* it is particularly remarkable, but not more so than in Convulsive Asthma. Sir J. Floyer lived in Oxford twelve years, and had little distress from his complaint; but he never visited Staffordshire, his native air, without a severe paroxysm or two. An Asthmatic, whose case will be related, for several years after the establishment of his disorder, could not stay a day in the place of his birth and the residence of his childhood, and which he had visited with impunity till the age of 30, without the same effect, though the cause of his disease was laid in a different situation, less favourable to its production.

The atmosphere produces effects on the Asthmatic, by several changes. When the

* Falconer's Influence of Climate.

mercury in the barometer stands as high as 30 inches, the density of the air is sufficient, *cæteris paribus*, to preserve the intermission of his disorder; and alterations from this standard to a lower, will be according to circumstances unfriendly. Besides a change from this degree of density, the state of the air may be cold or warm, cold and moist, or warm and moist; and rain, snow, or frost, storms, and fogs may give additional impression, but slight in comparison of the state which occasions their appearances.

The observations of Floyer on the influence of density, or rarity of air on the Asthmatic, are well founded and just. In a dense atmosphere, acrid miasmata, effluvia, and vapours are suspended high, and are therefore not so likely to irritate the pulmonary membranes; these floating particles will not so much offend the subjects of mucous irritation, as others, whose habits are characterized with equal sensibility, but whose pulmonary membranes are more naked of natural defence from lubricating lymph.

Vapours are, however, accused in all sorts of Asthmas, without reflection on the impurity, with which many Asthmatics inhale the atmosphere of London and Holland. In these places the advantage derived from its

density and pressure, more than balances the inconvenience arising from fog, and various animated filth, never perfectly cleared away or dissolved, but from its quantity and incessant supplies, always floating and being inspired.

In situations of greater altitude, impurities of the air are a more sensible exciting cause of Asthma, or possibly, it may be more accurate to say, that when vapours hang low in these situations, we have a certain index of the diminished density of the air, which would otherwise carry them off, and that the cause of their low suspension is really a state of atmosphere, producing at the same time the disorder of the respiration.

It may be said upon the same principle, that a dry and settled atmosphere is friendly to the Asthmatic, not only, because it is free from impure vapours, but, also, as having more elasticity to press upon the vesiculæ of the lungs.

The circumstances of the atmosphere render the combination of oxygen with the blood, difficult or easy. The soft and thin membrane through which it is absorbed, has been frequently, in its natural state, shewn to admit of the penetration of elastic fluids. The predisposition appears in Asthma unfriendly

to their union, and changes in the atmosphere may more materially obstruct it.

The usual density of the air being lost, a certain volume will in proportion have less weight, and press less against the membrane, and the same volume will have less oxygen to be attracted to the new affinity. Where the heat of the body so much promoting the process was before diminished, this additional change may be a serious exciting cause of the Asthmatic paroxysm.

A certain quantity of oxygen is consumed in less time, in the respiration of air which has great pressure, than in air of little pressure. Under the *greatest* pressure, which was made by an admirable chemist, whose abilities and success in experiment have been long acknowledged, the oxygen was consumed in less than half the time of the *smallest*, although the excess of the former above the latter, was much less than that which men experience in the common changes of weather.* If we reflect upon this circumstance, we must conclude, positively, that oxygen enters the blood vessels, contrary to

* See Minutes of the Society for Promoting Philosophical Experiments and Conversation.

the opinion of Dr. Crawford, and that pressure considerably encreases its penetrating force.

The objections which have been urged* to the accounts of Hæmorrhages, occasioned by great rarity of the air on high mountains, however ingeniously supported by experiments, cannot overturn the plain fact, of considerable disorder repeatedly known to be induced on the lungs by the weight of air being hastily lessened; though it is not to be supposed that concurrent causes in the habits of the persons affected, or greater proportions of unrespirable fluid may not occasionally operate in these regions. The pressure of external air upon the human body, is estimated at 32,000 pounds weight in some states of its density, in other states it is supposed to be reduced to half that weight.

The subject has been more accurately handled than is here necessary to specify, and particularly Bouguer,† appears, with the assistance of a pendulum, to have obtained great precision, in calculating the encrease or diminution of density of air, according to the degrees of ascent from the surface of the sea.

* See Dr. Darwin Phil. Transact. Vol. 64.

† Memoires de l'Academie, des Sciences, de 1753, p. 515.

The morbid alterations in the animal body, which are produced in consequence, are more the object of this inquiry.

An animal killed by exhaustion of air under the receiver of an air pump, has the right side of the heart and veins greatly distended with blood, and the left side almost empty.

An animal of equal vigour placed under a magazine of a condensing machine, will bear an increase of density of three or four atmospheres. The former animal expired in two minutes, the latter remained a quarter of an hour at a time, without any material inconvenience, and appeared to suffer most from returning to his customary medium of greater rarity.* In the first experiment the equilibrium was destroyed between the external air, and the air circulating with the fluids in a fixed state, which therefore expanded. This state the muscles of inspiration could not overcome, and the lungs being forced into a state of expiration, the blood could not be passed to the left side of the heart, from the collapse of the vessels.

In the second case an excess of air merely effected a more perfect and durable expan-

* Mr. Kite on the Submersion of Animals, p. 50, &c.

sion of the cavities, and thus facilitated considerably, the passage of the blood to the left side of the heart,* doubtless affording at the same time increase of vigour and stimulus to the actions of that organ.

M. de Saussure had experimental proof of the inconvenience to respiration, ~~from~~ great rarity of air, on the top of Mont Blanc, the mercury in the barometer at the same time, standing at little more than half the height which it did in the plain below. Sir W. Hamilton observed a similar difficulty of respiration on Mount Ætna, which he attributed to the rarity of the air, distinct from sulphurous vapour. Oxygen has been found in less proportion, as a component of the atmosphere in these high regions, than in the lower, which is an additional reason for disordered respiration.

If to the lightness of the air, *moisture* is added, the operation of its influence may be more injurious, and has frequently been felt in various situations, when the predisposition to Asthma was not present. This constitution of the air excited the disorder of respiration, treated of by Dr. Miller, under the name of Asthma.

* Mr. Kite, p. 52.

Heat and moisture appear to influence the density of the air, more than philosophers had conceived, before the observations of M. de Saussure, jun. appeared.* The effect of these adventitious circumstances is felt by other valetudinary subjects of relaxed fibre, as well as the Asthmatic, but by none more than the latter.

In *summer* and *autumn* the atmosphere is rare, and so far hostile to the Asthmatic; but to lessen this inconvenience, he enjoys the grateful sense of a warm skin, and general perspiration, by which the circulation is determined to the surface more than in the colder months. If it was not for this diversion in favour of the lungs, he would perceive much more of his complaint than he really does in the warm season, for many circumstances operate against him then which do not in winter. The profuse exhalation from the pulmonary vessels, excited to occasional excess from exercise or other causes, will more certainly take place in the hot months, and be more suddenly followed by the coldness, which is known to come upon

* Journal de Physique par M. L'Abbé Rosier, Tome XXXVI. Memoire sur la Densité, &c p. 98.

surfaces, and to be considerable, in proportion to the internal heat and the evaporation made from them. After this coldness is induced upon the lungs, the atmospheric air will not be properly decomposed in their cavities, the oxygen will not be absorbed and unite with the blood, and a consequent loss of vigour in the contraction of the heart and arteries, will be added to the local affection. The torpor of the exhalent orifices will follow these causes, or accompany the state, in consequence of original predisposition and the local impression from loss of heat. Then we have effusion without the power of customary evaporation, which is suspended in the progress.

Dr. Ryan* takes great pains to establish the doctrine of cold, occasioning this disease. *Cold and Moisture* check cutaneous perspiration, and diminish the heat of the lungs, there is, therefore, additional fluid circulating to the pulmonary exhalents, and there is less expiration of vapour in breathing. The skin may even be changed from a perspiring, to an imbibing state, creating an excess of water in the vessels. We have, therefore, in this state of the atmosphere, an exciting cause of

* Observat. on the History and Cure of the Asthma.

Asthma, as frequently as in moisture with warmth. Cold alone will not usually excite the paroxysm, though there are states of the atmosphere inducing great torpor on the pulmonary exhalents, without the positive presence of aqueous vapour, or moisture. The *East and North East Winds* are so piercing, as to overcome the influence which coldness, simply united with density of air, would have on the respiration, to the advantage of the Asthmatic. These penetrating winds are felt *intus et in cute*, by all persons of lax fibre and sensibility of nerve; but a frost in itself is friendly to the Asthmatic.

The east and north east winds, not only chill the lungs, and make their capillaries passive and incapable of contracting on their contents, but they check cutaneous perspiration inducing another cause of Asthma in catarrh. Why the cutaneous capillaries are constricted preceding their torpor, or in consequence of it, whilst the pulmonary capillaries are affected with torpor and dilated apertures, can only be satisfactorily explained by recurring to the predisposition of an Asthmatic subject; at the same time allowing the fact, that even when this predisposition does not exist, perspiration suppressed on

the skin, will always find an exit from the pulmonary capillaries, or those of the intestinal canal, unless an acute fever supervenes, from every passage being equally obstructed. This is proved by the moist expectoration of a mild catarrh, and by gentle diarrhœa from taking cold. In the Asthmatic subject fever does not readily come on, and the pulmonary vessels having more than equal debility with those of the rest of the system, the flux is discharged from them, and a torpor fixes them in the passive state which previously prevailed, or renders them less capable of resisting the current of fine serum impelled from behind.

Changes to rain or snow affect the Asthmatic, because of the decrease of weight in the air, which gives occasion to these alterations. Storms of any kind, are usually attended with sudden rarity of atmosphere, and according to the prevalence of excessive heat or cold accompanying the change, the Asthmatic will be more or less affected. Sir J. Floyer observes, with justness, these effects, but attributes too great consequence to the influence of matters floating in the air, apparently looking at phænomena as causes of Asthmatic fits, which merely follow changes in the density of air, as effects equally with these.

Active Motion in a warm air, with frequent respirations, produces great encrease of exhalation from the superficial capillaries, and from the lungs. The further augmentation of heat, is by this means prevented; but this is not the only consequence of profuse exhalation in the Asthmatic subject. The tone of his pulmonary exhalents is very weak, and the heat being suddenly carried off may leave them in too quiescent a state to contract upon their contents. But the general vascular tone, though lowered, not being reduced to the point of debility which locally affects these exhalents, and the *vis a tergo* being more forcible from occasional causes, the serous part of the blood escapes through the enlarged apertures into the vesiculæ.

The *Dissipation of Heat*, by this means, is productive of the most severe fits of Asthma. Floyer had most returns in the hot months, and they were likewise the longest. The month of August was particularly his enemy, and I have seen in August and September more serious paroxysms than in any other. It must be observed, that in this period of the warm season, the condition of the body is relaxed, by the impressions of the heat having continued for several months, and

the predisposition to be influenced by this exciting cause, and by the great rarity of air, is much stronger than in the earlier months.

But heat may be carried away from the body, by other means besides exhalation, and this effect takes place in frosty weather, but not usually with the same consequences to the Asthmatic. A *frosty air* is more dense, has more weight for its bulk, and contains a greater proportion of oxygen in the quantity inspired at every inspiration. A person will also breathe quicker in this air, and therefore takes more frequently a change into his lungs, oftener decomposing it, inhaling oxygen, and discharging carbon. The influence of cold upon the capillaries would be injurious in this case, if not speedily counteracted by the animating stimulus of this remedy for the beginning torpor, the weak contractions of the vessels, and the more chronic poverty of blood*.

The effects of cold are partly exemplified, by entering a cold bath, when there is a torpor of the pulmonary capillaries from sympathy, with the subcutaneous capillaries,

* See Dr. Crawford Exper. and Observ. &c. also Minutes of the Society for promoting Philosophical Experiments and Conversation. Exper. &c. concerning Respiration.

which, of course, are first affected by the cold.* This occasions a cold breath and quick respiration, and in some degree illustrates the torpor, which the pulmonary capillaries sustain in Asthma, from the influence of cold coming suddenly upon them. But in Asthma, the torpor commences with the pulmonary capillaries, whilst the subcutaneous are not more strongly affected, than may be supposed from the predisposition which had long subsisted; and the heart and large vessels have not in Asthma a corresponding torpor, which certainly in the cold bath must be universal, that is, there must be universally in the sanguiferous system, less active contraction of vessels during this powerful and sudden abstraction of heat, giving an increase of irritability to be excited, with more effect by the usual stimulus of common heat when the cold medium is no longer applied. A torpor of the pulmonary capillaries from going into the cold bath, will not be followed by effusion in the manner of Asthma, because the predisposition may not be present, and if it was, the *vis a tergo* is rendered passive in proportion to the quiescence of the arterial capillaries of the lungs.

* See Zoonomia.

In Asthma the *vis a tergo* does not correspond with the debility which affects these capillaries.

Besides the abstraction of heat locally or generally inducing vascular quiescence, a deficiency of other stimuli may occasion the torpor. *Distention* is a stimulus which excites the actions of the whole arterial system, and therefore the paroxysm of Asthma may be excited by withdrawing part of this stimulus.

Profuse Bleeding, spontaneous or artificial, may leave the vessels with too little stimulus from their contained fluids, and this deficiency of stimulus will be owing to the want of distention, and to the want of pungent quality, conferred on the fluid by the presence of red globules and gluten. The mouths of capillary vessels will in this case not contract to their healthy strictness of diameter, and the fluid being thinner, as well as weaker, will more readily escape.

“ Animals,” says Dr. Hales, “ when they are near expiring, do usually breathe quick, the lungs then labouring to heave fast, that the languid blood may thereby have a freer course through them, to supply the then almost bloodless pulsations of the

“ heart, as was the case in the experiment
“ of the mare when her blood was near ex-
“ hausted.”*

When by the great evacuation of blood, the vessels lost their stimulus of distention, the animal fell into cold clammy sweats, which could not happen from the protrusive force of the blood, but must arise from the relaxation of the capillary exhalents.

There is reason to apprehend, that an injudicious use of the lancet in pulmonary complaints has brought on Asthma in some instances. I am certain of this effect in others where Dyspeptic pain of the stomach was the supposed indication of pneumonic inflammation.

Violent Purging or Vomiting may be an exciting cause of the paroxysm, or the acrimony of indigested matter in the first passages productive of those evacuations, may at the same time, irritate the respiratory muscles of the abdomen and thorax, into such an excess of contractions as take the character of the disease. But considering the exhaustion and debility occasioned by purging, and the want of stimulus to the stomach after vomit-

* Hales' Statical Essays. Vol. II. p. 6.

ing, the alimentary canal is left in a condition powerfully adding to the state of habit, in which the predisposition to Asthma so much consists. This artificial depletion is not less productive of the fit, than fasting is.

The *Want of Food*, or an absurd neglect of regular meals, will as certainly excite the paroxysm in some asthmatics, as a moderate and light supper of tender animal food will alleviate the distress of others, when in some instances of long established complaint, the approach of the fit was plainly indicated by the feelings of the patient.

There is, therefore, a critical attention necessary to the calls of the stomach, and the power of that organ to perform digestion. The first should never be neglected, and the latter never oppressed. If the stomach is loaded, the fit will be more violent, than after the occasional cause of fasting.

Fasting, is not only an exciting cause of Asthma, but it will, according to its extent, encrease the predisposition to the disease, by lowering the heat of the body. Animal heat may not solely be dependent on the decomposition of the air in the lungs, or, if it is, that operation is much influenced by causes

variously affecting the habit, through the medium of the alimentary passages and otherwise; local inflammation raises the temperature of the body, but sleep depresses it, and fasting inducing weakness, very considerably diminishes the heat.*

A sudden *Encrease* in the *Impulse* of the *Circulation* may excite the paroxysm of Asthma. It may be supposed that previous to the effusion of serum, a gradual distention of the vessels has taken place, with accumulated contents. Dyspnoea will attend the course of this alteration in the tone of the vessels, and encrease with the disease. When the vessels are no longer dilatable, they will be ruptured, or effuse by their capillary branches their serous fluid. Exciting causes will accelerate this event, and rapid or violent bodily motion by impelling the blood suddenly to the lungs is one cause.

Sir J. Floyer places amongst the causes of the Continued Asthma, the “straining of the lungs by running.” Though his explication of the straining does not apply to the condition of the blood vessels, and their contents, but to the fibres “betwixt the lobes

* See Mr. J. Hunter, on Animals producing Heat, also Dr. Percival's Essays, Vol. II. on Famine.

“ of the bladders,” which he seems to suppose affected, as if they constituted a part of the locomotive muscles, we may accept his practical fact, without assenting to his reasoning.

Upon the *Suppression* of the *Hæmorrhoidal* or *Menstrual Flux*, a subject disposed to pulmonary accumulation of blood, or to weak and dilatable vessels may suffer Dyspnœa, or a paroxysm of Asthma, according to the extent of disease and predisposition. A restoration or promotion of the suspended discharge removes the difficult respiration.

The same may be said of *Repelled Eruptions* or *Gout*, but causes of this kind excite the regular convulsive paroxysm, only in persons who have before sustained it. If the breathing is affected from those exciting causes, when Dyspepsia and the Asthmatic habit is not established, the affection may be rather called Dyspnœa, or if attended with fever, pneumonia or peripneumony.

The Membrane of the air pipes of the lungs is defended more considerably from the acrid particles floating in the air, in the species of Asthma now under our consideration, than in the natural state where this disease is absent.

But the pulmonary system of an Asthmatic is at all times very irritable, from the repetition of paroxysms, which it has sustained, and slight offences will therefore induce a fit.

Dust of any kind is an exciting cause. Hair powder has been observed in many instances to bring on first sneezing, then by association of muscles a more extensive system of powers are put in action, to eject the inconvenience, which may, possibly, have only touched some points of the trachea uncovered by mucus.*

Metallic Fumes are very pungent, and will shew their effect on an Asthmatic by exciting a paroxysm.

The *Smook of Tobacco* is in most cases offensive to the Asthmatic, and even when the habit of inhaling the fume is pursued, and absurdly thought to be a remedy for the disease, the patient, by inspiring the qualities which are constantly being ejected in natural respiration, opposes the desires of the animal œconomy, and strengthens the predisposition to this disease. It is affirmed that smokers are Asthmatic, and Diemerbroeck found their lungs dark coloured, approaching to black, and ulcerated.†

* See Floyer's Treatise, p. 74, &c. † Diemerbroeck. Lib. II. p. 444.

Sir J. Floyer mentions a patient, who smoked to cure a pain in the stomach, and by this means acquired the Asthma.

Fetid Smells are sometimes causes of the fit, but not often, unless gross particles not dissolved, but diffused in the air, are received into the trachea.

Strong Perfumes, generally acknowledged sweet, are as likely to excite a paroxysm as fetid smells. They all phlogistificate the air, to a small degree, and though the eudiometrical experiments of M. Achard prove no considerable injury from the mixture of these fumes with common air, the sensible membrane of the trachea and bronchia of an Asthmatic, is a test which frequently supersedes all reasoning from philosophy.*

The *Aerial Carbonic Acid* is an exciting cause recorded by Sir J. Floyer. I have known the inspiring of the vapour of fermenting substances in brewing, to be followed immediately by the paroxysm.

This air, or inflammable air, acts in a more perfect exposure by destroying sensibility and irritability. Anticipating by strong

* See Journal de Physique, Tome 26. De L'Effet Des Partum: Sur L'Air.

impression the reaction of the powers of life to eject its influence. See *Memoires par M. Portal. Sur Les Effes Des Vapeurs, Mephitiques dans L'Homme.**

The *Passions* of the mind may excite à paroxysm, or strengthen the predisposition to it.

Anger shews its effects on the circulation whenever it occurs. The fluids separated from the blood, are determined to their excretories in greater haste, and in larger quantity. Hence a redundancy of saliva, and of bile, and a straitness in breathing are not uncommonly the result of an impetuous fall of anger. The Dyspeptic disposition is still more certainly encreased. *Joy* encreases the vigour of the heart and arteries, and may therefore impel the circulation before circumstances have allowed a restoration of contractile power to the capillary exhalents of the lungs, their orifices may then let the serum escape. *Love, Grief, Terror*, appear to distress the mind and relax the habit; they may not in this view so frequently excite the paroxysm, as they may add to the predisposition which leads to it.

* Histoire de L'Academie Royale des Sciences, Annee, 1787.

The Asthmatic is ill calculated for the exercise of *Veneréal Pleasures*, however he may be prompted by sensation or taste to pursue this indulgence. Gratification not uncommonly excites the paroxysm.

Severe Study affects the digestive powers, and therefore promotes predisposition. The sedentary life which literary men pursue very probably is the intervening means of producing a morbid state. Study, considered in itself, can scarcely be thought injurious. Ardent thinking, attended by the occasional satisfaction of useful discovery, and the hope of reputation, may animate the body, and invigorate the mind, but these advantages are more than balanced by encreasing disorder of the first passages, from want of exercise so necessary to the peristaltic action of the intestinal tube.*

If the *Changes* of the *Moon* ever influence the motions in animal bodies, they may be supposed with great reason to excite the paroxysm of Asthma. It appears that the attractions of the sun and moon at some periods combine their powers, and influence the gra-

* See Tissot De La Santé Des Gens De Lettres.

vity of bodies with greater effect. These united powers are calculated by Sir I. Newton, not to exceed one 7,868,850th part of the force of gravitation : and yet this comparatively small power can raise the tides at the equator above ten feet high. If the lunar influence produces a small degree of quiescence at first, and if that recurs at certain periods, even with less power to produce quiescence, yet the effect will daily encrease by the acquired habit acting at the same time. The quiescence may commence at any hour when co-operating with other causes, it becomes great enough to produce a disease. Afterwards it may continue to recur at the same period of the lunar or solar influence. The same causes operating with the acquired habit, that is, with the catenation of this new motion with the dissevered links of the lunar or solar circles of animal action.

The periodical returns of Asthmatic paroxysm, dependent on a quiescent state of the capillary exhalents of the lungs, claim attention from the physician to these probably exciting causes; but the subject is yet involved in principles so difficult of application to the fluctuating phænomena of disease, that I cannot affect to inform from personal

observation. The ingenuity of the author of *Zoonomia* has rendered probability to conjecture. He is the only writer who gives any satisfaction to the curious inquirer on this obscure subject, and who has ever countenanced the Hippocratic doctrine of critical days, by the support of reasons derived from natural facts. See *Zoonomia*, Vol. I. XXXII. 3.

Errors in Diet are a copious source of inconvenience to the Asthmatic, as may be expected from considering the Dyspeptic condition attending his disorder, and radically united to its cause. Under this head may be specified, drinking too much of strong liquors, or liquors full of carbonic acid, with acescent materials in the composition, sweet wines and new beer. Profuse indulgence in the use of tea, and warm watery liquids of all kinds; these are exciting causes of Asthma. Heavy suppers, eating between meals, and generally, all food of difficult digestion, may produce the same effect; such are smoked meats, pastry, fat pork or beef, water fowl, raw vegetables, fallads and unripe fruits, also boiled cabbage and carrots, rich soups, jellies, and sauces. These alimentary substances are not readily governed by the stomach of an

Asthmatic, but remain till a fermenting process takes place, and if purging or vomiting brings no relief, the paroxysm may be excited; even when these evacuations occur the consequence is not often prevented. Every thing which in Dyspepsia ought to be avoided, should be abstained from by the Asthmatic, who must rigidly believe that his paroxysms may be more frequent, or the intermissions longer, according as the seductions of the table are too powerful for his prudence, or are resisted by his care. Intoxication, and surfeit are so conspicuous amongst the worst of his enemies, and have so little allurements where the habit is infirm, that an Asthmatic is not to be suspected of suffering from the excitement of these gross errors.

Our INQUIRY into the causes of Convulsive Asthma, such as it will be found in practice nine times in ten, has now embraced disorders of respiration which have been acknowledged to follow obstructions in the pulmonary system, by all pathologists, or which have been proved to proceed from the immediate oppression of extravasated serum in the preceding sections.

In examining the remaining varieties of this disease, we leave a scene of sensible appearances, and approach the ground where our path is not so plain, and the object of our inquiry more obscure. But analogy is still distinct, and we have ascertained some fundamental laws of the animal œconomy, which bestow no inconsiderable light upon its relations.

 SECT. XIII.

Second species of Convulsive Asthma from the irritation of acrid effluvia in the lungs.—*Diagnostics of this species.—The Remote Causes.—Condition of the mucous membrane.—The nature and effects of effluvia.—Odours.—Instance of a convalescent from the disease of Mucous Irritation.—Deductions.*

THE *Second Species of Irritation*, seated in the pulmonary organ, and immediately causing a paroxysm of Asthma, is the *Acrid or Offensive Quality* of some unobserved matter, conveyed by the air, and attached in the act of inspiration to the sensible membrane lining, the tracheal and bronchial pipes. This may be connected with the causes explained in the preceding sections, but it may also be unconnected with *sensible bulk*, and yet

equally excite the *Motus Medicati* to dislodge it, creating a form of Asthma treated of by Nosologists with as much obscurity as they attribute to its origin. But the *Nisus* of nature, immediately following the irritation of this extraneous subtle matter, it may justly be said to embody the proximate cause of the disease.

This form of Asthma is to be distinguished by the absence of copious expectoration, and sometimes there is no expectoration at all, particularly when the complaint goes off abruptly and soon, for then the offence is probably removed by change of air and strong expirations.

If the fit continues long, the irritation produces an increased action in the excretories of the mucous membrane of the bronchia, and expectoration will be the consequence, but when this expectoration takes place the symptoms will generally subside, because the irritating cause becomes enveloped in mucus, unless the habit has arrived at that acute state of morbid sensibility, in consequence of which, convulsive motions are likely to remain, and return at intervals, the original excitement of them being removed. Wheezing is not a symptom, unless the long continuance of the fit should induce a secretion of

mucus sufficient to straiten the bronchial passages. The Aqueous Diabetes is also absent, but the action of the intercostal and the abdominal muscles, is the same as in other varieties of disordered respiration. Whether a spasmodic constriction of the bronchia takes place or not, I am entirely ignorant, for reasons before delivered.

In attributing Asthma of this kind to irritation, I reason entirely from analogy, which informs me that the muscular motions which take place, indicate an offence in the lungs, and as this offence is not apparent to the senses, I prefer probable conjecture in reasoning on the few instances which this species offers, to deranging the induction established in a great majority of cases of Convulsive Asthma, by assigning to similar effects causes dissimilar.

The Predisposition to this species consists in a habit more sensible of slight offence than is common in the Asthma from mucous irritation. The hydropic diathesis is never present, and frequently the tone of the vessels of the lungs is not weak. Some turgescence of blood may appear in the face, and bleeding, if not positively useful, is not commonly injurious. Dyspepsia accompanies the attack, but not with violence. The peculiar mark

of predisposition to be attended to, is the morbid sensibility or irritability of the body, perpetually susceptible of spasmodic muscular contraction from inferior causes of offence; this habit is more liable to pulmonary irritation, from the dryness of the Schneiderian membrane, which in this species is a Remote Cause.

Many authors distinguish this disorder, by calling it the *Dry Asthma*. Etmuller particularly makes *Wheezing* the diagnostic, which, by being absent or present, points out the *humid* or the *dry*.^{*} They all allow some little mucus to be spit up in the latter, but the line which they have drawn takes too many cases from the species before treated of, and enlarges the list of the present, more than experience will be able to defend.

We must recollect, that mucus may be more or less separated, according to the state of the system. The glands, or simple capillary exhalents are too relaxed in one state, and the discharge is copious and occasionally oppressive, but this condition of the pulmonary membranes, however inconvenient, is not very liable to irritation, from miasmata floating in the air, which would be a cause

^{*} Vide Opera, Tom. I. Cap. XIII. p. 176.

of additional distress to the respiratory function. The sensible membrane of the trachea is defended by the mucous coat from the attack of aerial acrimony, as far as the condition of the body, varying, notwithstanding in sensibility to external impressions, will admit of this defence. Other things being equal, this guard is efficient in a very important degree, and complies with the purpose for which it was designed.

But if there is a deficient secretion of lymph upon the membrane of these air pipes, and absorbing power is active, its surface will want the lubricating moisture, which in a better state would have defended it. In this case, irritation may offend it by a thousand imperceptible points which the air conveys in the act of inspiration.

It is said, that then a perpetual dry cough, inflammation, and hoarseness follow,* but these unequivocal symptoms of phthisis do not constantly attend. A more ambiguous state may prevail, which inclines to Asthma, though the danger of phthisis will always be considerable, if situation exposes the patient to the repeated or permanent application of the irritating causes.

* Observat. on Phthisis, by W. White, M. D. p. 63.

As to the matter of irritation it is too subtle for analysis, but we conjecture that it is diffused in the air. *Effluvia* issue from bodies of the densest texture, and are discovered by the odour of all aromatic substances. Dr. Lister found a number of stones, which had been laid in drawers made of Barbadoes cedar, thickly covered with a liquid rosin, like Venice turpentine, though no manner of exudation appeared in any part of the cabinet. He concluded, that all the turpentine of the cedar wood had been carried into the air, and then condensed into its fixed state upon the stones. And that all odoriferous bodies spend their very substance in effluvia.*

The magnetic and electric influences depend upon still more subtle effluvia, whose activity is sufficiently known by its effects.

The astonishing divisibility of matter admits of proof to an extent which vindicates the inference of effluvia consisting of suspended particles.

Mr. Boyle shews an instance of the divisibility of one grain of copper, and proves that this portion of matter imparted a conspicuous

* See Philosoph. Transact. No. 110. p. 224.

colour to above 256,806 times its bulk of water ; a manifest tincture to above 385,200, and a faint, but discernable colour to above 530,620 times its bulk of water.* What then may be expected from the solvent qualities of the air, or from its capacity of serving as a medium of division of the particles diffused in it?

The influence of odours upon different people will be varied according to an idiosyncrasy which determines them to be agreeable or not. Musk is offensive to many, whilst others delight in its effluvia. Mr. Boyle gives many instances of the effect of odours on the sensations of man, and when it is proved that such odours are offensive, there can be little hesitation in admitting the probability of their inducing Asthma, when the body has the predisposition before stated to assume the paroxysm of that disease. It can also be readily allowed that particles not qualified to affect the sensations, may operate upon the irritability of an Asthmatic, by giving an offence to the pulmonary function. Or they may be received in a state so very diluted that the membranes may not suffer

* The Hon. Mr. Boyle's Works by Dr. Shaw, Vol. I. p. 409.

from their impression, until by accumulation and mutual attraction they may assume a more condensed and substantial form; and by their pungency become suddenly offensive in the lungs.

Influence of this kind is most prevalent in populous or manufacturing places. There are persons whose sensibility of impression immediately excites a cough upon their entering a town. And others sustain a more extensive reaction of muscular contraction in the paroxysm of Convulsive Asthma, if they come out of the pure air of the country and sleep in a town. The greater or less pressure of the atmosphere modifying, to more or less advantage, this inconvenience.

The simplest case of reaction in the pulmonary system is that of expiration by cough, and the resistance of the trachea by shutting of the glottis to the entrance of further acrimony: this is exhibited in acute energy when an animal is exposed to breathe unrespirable air. His expirations exhaust the lungs of good air, but nature opposes the replenishing them with bad.

If the irritating matter is too subtle for observation, it may be excreted in the vapour

of expiration, as it was received without immediate perception of its inconvenience in inspiration.

Many of the exciting causes of the paroxysm in the last species of Asthma may be here considered as proximate, because they induce no intervening irritation more near to the actual symptoms than themselves.

When effluvia fall upon the pulmonary membrane, the irritation of the particles will be more extensive and more sensibly felt according to its state of dryness. But in proportion as the general habit is firm, and little disposed to that condition which is popularly called *nervous*, though the local irritation is acute, the inordinate contractions of the respiratory muscles will be less readily excited. If on the contrary the habit has been acquired of muscular convulsion, by frequent association of respiratory muscles and frequent repetition of an irritating cause, the Asthmatic paroxysm may much more probably supervene, upon the milder effort to eject an acrid particle by sneezing or cough.

When an Asthmatic is convalescent from the disease of mucous irritation, he is very liable to be the subject of this variety. The absorbing system is put into additional acti-

vity by the plan of cure which, it will appear, is the only successful one in treating that species. The habit of the Asthmatic is generally strengthened, and the morbid laxity of the pulmonary exhalents considerably removed. There is, therefore, less danger of effusion, and greater absorbing action, according as the progress of the cure proceeds; but the *sensibility* of the pulmonary system is not reduced to a healthy standard, and the *force of habit* is yet to be overcome. The irritation of effluvia on the pulmonary membrane may therefore excite the usual muscular contractions to eject an offence, and will sooner produce this effect upon the respiratory function of a person so recovering than when it was defended by the lymph covering its membranes, because fortunately the irritations of mucous and aerial acrimony do not readily come into action at the same time.

I have had frequent experience of this fact; particularly in an Asthmatic restored from the state described in the preceding sections, whose Schneiderian membrane became unusually dry as the cure proceeded, and was even affected with frequent inflammation. The fluctuating qualities of the air frequently irritating this membrane, occasionally pro-

duced a paroxysm without expectoration, until the habit of relapse was conquered by the means pursued.

In the preceding sections it was established, that the convulsive actions in Asthma proceeded from the immediate irritation of some *bulky obstruction* in the lungs, and in the present section analogy shews that the same effect may be caused by the irritation of *acrimony*, always present in the atmosphere in greater or less degree, and ready to be inspired.

I am, therefore, at liberty to adopt the position formerly assumed, as a deduction from reasoning, analogy and facts, that
“ *Certain Inordinate Contractions of the respiratory muscles indicate the presence of a matter*
“ *offending the pulmonary organ by its oppressive*
“ *bulk, or acrid quality, or both.*”

SECT. XIV.

Inquiry, if the immediate cause of Convulsive Asthma may be extraneous to the thoracic cavity.—Association and sympathy of muscles.—The final cause and indication of sympathies.—The muscles of respiration are subservient to the functions of several organs in the abdominal cavity.—Their associated contractions indicate perceptions of offence to those organs.—Convulsive Asthma is occasioned by Irritation in the Abdominal Viscera.—Instances of this cause.—General Deduction.

WE shall now inquire, whether this convulsive disorder of the respiratory muscles may proceed from irritation in any other part of the œconomy, as has been asserted? Circumstances defend the conclusion of these actions having been excited in some instances by irritation, external to the thoracic cavity,

but it cannot be made to appear with certainty, that the irritation of extravasated serum, or of aerial acrimony, was not present in the lungs at the same time. The former irritation might be removed by the unobserved power of absorption; and the latter might be carried off imperceptibly in the vapour of expiration.

It still remains probable, that in some cases the offending cause is seated in part of the viscera below the diaphragm.

We are obliged to recognize a law of the animal œconomy which has been before appealed to.* A Sympathetic Association of muscular contractions is known to take place, when the fibre of one muscle is irritated. In this manner tenesmus brings on strong peristaltic action of the whole intestinal canal, and also of the abdominal muscles and diaphragm. This affection of the rectum is also excited when the upper part of the canal is alone primarily irritated; it proceeds also, as well as stranguity, from inflammation of the uterus. A stranguity and tenesmus mutually occasion each other. These are sympathetic affections of parts nearly contiguous; but association of actions is still more extensive.

* See Sect. II.

An irritation of the neck of the bladder, or extremity of the rectum was observed by Dr. Whytt, to be the cause of a constant contraction of the Diaphragm and abdominal muscles.* When the uterus is irritated by inflammation or pregnancy the first passages are much disordered, and vomiting is frequently excited. In labour, the most violent contractions of the abdominal muscles and diaphragm take place, in other words the muscles subservient to respiration are excited with great energy, and powerfully assist in delivering the organ from its burden.

In reasoning upon sympathies, Dr. Whytt opposes the opinion, that these affections are occasioned by anastomosis of nervous branches, and gives examples of more consistent sympathies, which, on this theory, might be expected to take place, but which do not usually appear. It may be demanded, if the difficulty is removed by referring all instances of consent of parts to the common sensory, without tracing the design of the several motions? Doubtless, whatever be the origin of extraordinary sympathies, the *final cause*

* See Whytt on the Vital and Involuntary Motions. Also his Observations on Nervous Diseases, p. 26, &c.

is the good of the animal œconomy.— This may not clearly be distinguished in the progress of symptoms perpetually accumulating upon the diagnostic indication of primary offence. Error and obstinacy, the pride of system, and the influence of authority, have conspired, in too many instances, to obscure the plainest indications of nature, till her operations become too complicated for the most sagacious experience to unravel.

Dr. Whytt discovers, in the sympathies which he enumerates, some that are marked with a *Wise Intention*. He instances the contractions of the abdominal muscles and diaphragm in tenesmus, stranguary and labour; in sneezing, coughing, and the hiccup; and the “increased motion of the organs of respiration in the fit of an Asthma, they are,” says he, “the efforts of nature to free the body of *something hurtful*.”*

The “*Wise Intention*” of all the sympathies may some time be elucidated. Those muscles which serve the function of respiration, are never excited to extraordinary contractions, without affording to the considerate observer the indication of something hurtful, which is now offending, or which has offend-

* Sympathy of the Nerves, p. 72.

ed, an organ in the thorax or abdomen, which it was the natural business of an individual muscle, or the set with which it associates, to endeavour to discharge by some emunctory.

After an attentive consideration of the experiments and deductions of men of superior science, it will appear safest to admit the inference, that *Sensation* and *Irritation* are distinct properties of the living animal. It has been proved, very satisfactorily, that certain instinctive actions, calculated to avert injury or pain, may be independent of nervous influence, and are exerted without the intervention of the sensorium commune.*

But though this distinction, pointed out by Glisson, enforced by Baron Haller, and acceded to since by the best authorities in physiology, is defined upon just grounds of experiment, it does not follow that the influence of sensation may not be communicated from the nerves, in which it is inherent, to the muscular fibres, though the latter may proceed to contract without such a medium of stimulus.

If instinctive actions are therefore performed by the muscles, without nervous excitement,

* Vide Croonian Lecture on Muscular Motion, by Dr. Blane, p. 36, &c.

they are also performed in consequence of that excitement, and their contractions take place without the possibility, in general instances, of distinguishing where the stimulus was first applied, on the muscular fibre or on the nervous filament ; but in addition to this general presumption, it is proved, that the contraction of a muscle may be excited by irritating the nerve leading to it, whilst the nerve itself is unaffected.

We have thus obtained a certainty of the influence of the nerves on the muscular fibre, and it is of little importance to know if this influence is mutual ; every purpose of practice is answered by the assent to this position, that the *sentient extremities* of the nerves, and the *moving* or *muscular fibres* have an essential correspondence, so strict as to induce the opinion of some physiologists that they are extensions of the same nervous medulla.* The sentient nerve gives the fact of exciting contractions, and corresponding by sympathy, with distant parts. The muscular fibre is susceptible of the excitement of the *vis nervosa*, and it is also irritable by stimulus in consequence of the *vis insita*.

* Vide Dr. Cullen, Institutions of Medicine, also Boerhaave, Instit. p. 395.

The objections advanced by Professor *Monro*,* to the independence of the *vis insita*, are supported by experiments which appear to leave the question exactly on that footing, and no otherwise invalidate the conclusions of *Haller*, deduced from the positive irritability of the heart, after a perfect separation from the body.

It is not, therefore, proved, that a necessity exists of always applying to the cerebellum to obtain those motions which exhibit a “wise intention” of relieving an organ from something hurtful.

These salutary actions are, in common instances, excited without consciousness but of the general effect to be produced; such are sneezing, coughing, and laborious respiration, belonging to the pulmonary organ. Vomiting, and discharging feces belonging to the alimentary canal, and passing urine, an action of the bladder; in all these motions, though unconsciously excited, the muscles of the chest and abdomen are active instruments.

Mr. Hunter† takes notice of the analogy between coughing and vomiting; in the former the lungs are passive, in the latter the

* *Observat. on the Nervous System*, Chap. XXVII. also *Dr. Smith's Tentamen Inaugurale*, p. 45.

† *Vide Observations on Digestion*, p. 200.

stomach is not necessarily active, as the powers of the diaphragm and abdominal muscles are competent to empty the stomach as well as the rectum.* The muscles of respiration are the active instruments of emptying the lungs, and the same muscles are assistant in evacuating the lower viscera. This natural alliance of powers frequently comes into exertion, when their union would not be necessary to produce the effect desired. In violent coughing to discharge extraneous matter from the lungs, the stomach is compressed, and the diaphragms coming into action, vomiting is brought on. On the contrary, acrimony in the stomach and duodenum excites the associated efforts of the respiratory muscles, which act by sympathy, as if the cause of offence peculiarly disturbed the lungs.†

The author of *Zoonomia* looks beyond these natural catenations of muscular motions, and is desirous of finding more remote connections of cause and effect, than I apprehend can be supported by the testimony of experience.

* This was also the opinion of the French Physicians, but it has been confuted by the Experiments of Mr. Haighton. See Mem. Med. Soc. Vol. II.

† Vide Willis de Morbis Convulsivis, Vol. I, Chap. xii.

After many difficulties in arranging the theory of Asthma, he concludes, summarily, that the Humoral Asthma has but one remote cause, which is the torpor of the pulmonary vessels, or the want of absorption of the pulmonary lymphatics. And that the Convulsive Asthma is like other convulsions, or epilepsies, “ and may be occasioned by pain in “ almost any remote part of the system.”

He is more confirmed in his opinion from knowing an instance of one lady, whose Asthma ceased, on her being afflicted with pain, and gouty swellings of her large joints. A young man was also seized with Asthma from the retrocession of eruptions on his face.

The laborious respiration of infants in teething is also stated to be the Asthma Convulsivum exerted to relieve pain.

In adults, the author gives no example of the supposed pain being seated farther from the lungs than the liver, or biliary ducts. And the relief by pain being transferred from the trunk of the body to the limbs, with a cessation of Asthma in consequence, must be admitted as evidence of the disease being occasioned by a cause seated in the trunk of the body, if the fact is appealed to.

The teething of infants may produce quick respiration, but has the observing Physi-

cian remarked that it was then unaccompanied by fever, or disorder of the first passages? Pyrexia distinguishes it from the Convulsive Asthma of adults; and an affection of the stomach and bowels, almost constantly attending dentition, permits the inference that spasmodic respiration may be intended to remove that uneasiness.*

Has any practitioner observed Convulsive Asthma to be excited, as is *Tetanus*, by a prick of the toe? It is natural to believe that where the lungs shew no indisposition, and where no mucus is excreted in the progress of the complaint, an inconvenience may have been oppressive in those other viscera whose functions are served by the muscles which are excited to extraordinary contractions. The intercostals, the diaphragm, and the abdominal muscles are the common property of all the middle and lower viscera, and discover their uses when fæces of the blood are to be expelled from the lungs in mucus, or in the aerial form of carbonic acid and vapour; when acrimony is to be expelled from the stomach by vomit; when excrement is to be discharged from the bowels, and urine from the bladder, or a stone from the kidneys, ureters or bladder;

* See Zoonomia, Vol. II. III. I. I. 10.

and when extraneous fluid or foetal production is to be propelled from the uterus. Should something hurtful be lodged in any of these organs, the muscles we have mentioned may naturally associate their motions, and the indications are not obscure; until there is good evidence of a more remote seat of the immediate cause of Asthma, it is unphilosophical and useless to desert these limits.*

In the first part of this Inquiry there are instances of disordered respiration from causes situated in the abdominal viscera, and though the form of disease which they assume is generally that of Continued Asthma or Dyspnœa, exacerbations may be often periodically marked, and are the increased *motus medicati* exercised with unavailing effort to discharge the offence.

When these permanent and mechanical causes do not exist, the paroxysm may assume its regular form from the immediate irritation of a temporary offence in parts below the diaphragm, especially the hollow muscles.

* A very curious case of Convulsive Cough is recorded by Dr. Whytt, arising, seemingly, from consent with the sensations of the lower extremities, but the respiration in Asthma is performed by a complicated association of muscles, of which a cause similar to that of the Convulsive Cough is not yet known.

The relief which is sometimes obtained by vomiting or purging, affords evidence that acrimony in the *stomach* or *bowels* was a cause of the Convulsive Asthma. But the example is not to be confided in where the paroxysm does not totally subside in consequence. If the convulsive respiration clearly goes off we have considerable proof that in these instances, which are, however, very few, no other acrimony or offence excited the actions than what was seated in these passages. If, on the contrary, the paroxysm does not entirely subside, we must remain in doubt, or by a prudent comparison of symptoms, decide, whether the remaining motions are the actions of *habit*, or excited by irritation in some other organ. The necessity of such deliberation too often occurs in practice, and according to the sagacity of the physician, great credit may be obtained by unexpected relief given by antispasmodics, or patience must be still exercised in waiting for expectoration, or some other discharge.

Irritations of different organs, doubtless, frequently occur together, but the *stomach* and *duodenum* are their principal seats. Floyer does not rest upon the principles here delivered, but he gives histories confirming the fact,

in himself and others. No writer has before applied these muscular motions to the natural purpose which, in Asthma, ought to embrace them, but instances of great disorder of the first passages or *biliary ducts* may be noticed in their remarks. Dr. Ferriar* gives the case of a lady whose paroxysm terminated with sickness and vomiting. Millar gives these evacuations, or the discharge of wind, as the critical relief in the disease which he described.

Willis speaks of Asthma from sympathy arising from a stone in the gall bladder.

Hoffman has cases of the same kind.†

I have met with several in which disorder of the stomach was only indicated: a lady was affected with orthopnoea and great distress every night; she had an inveterate acidity and inflation of the stomach. The respiratory motions were truly asthmatic, but the symptoms all disappeared upon a return of healthy digestion, which had been disturbed in this violent manner by an unhappiness in her family, and was restored when the secret cause of uneasiness was removed:

* Med. Hist. &c. Vol. II.

† De Asthmate Convulsivo, Obs. 2. 4.

she had, however, frequently discharged from her stomach, acid or bilious matters with relief.

The *Hysteric Asthma* is, probably, generated from the same state of the first passages in many instances, and if attended with wheezing, this symptom is readily explained by the great distention of the Œsophagus and consequent pressure of the trachea.

An Asthmatic at 16 years of age parted with a considerable quantity of ascarides and some round worms, and had no fit for two years afterwards.*

A stone found in the *kidney* of an Asthmatic, recorded by Ruysch, might add to the force of pulmonary irritation exciting the disease.

The *uterus* may be the seat of acrimony or stimulus of distention, which, I have no doubt, sometimes occasion Asthma, and are frequently added to its causes. Females, who are of constitutions peculiarly irritable, and still more if they have sustained dyspnœa, may readily fall into the paroxysm at the period of menstruation, when the uterus is turgid with blood, creating a perception of something to be discharged. In such an instance can any

* Under the care of Dr. Thos. Bree, who related to me the fact.

effort be more natural than that of the very muscles which are so often employed in propelling substances from the uterine cavity?

The hysteric lady in Floyer began to suffer Asthma at the age of fourteen. Distress of mind is described as a remote cause. Dyspepsia followed, and acrimony of the stomach, with a particular condition of the uterus might unite, in immediately producing a paroxysm.

Dr. Wainwright knew a lady who had a fit every time her menses flowed, and was worse for all medicines for seven years, but afterwards had relief.*

Asthma, from irritation in the uterus, is probably liable to be carried into excessive convulsions when the acrimony is permanent and continually inciting the *Motus Medicati* without relief. It appears from the following history, that in these circumstances epilepsy may supervene. A young person, ill of the Asthma, was unexpectedly attacked with epilepsy. The fits of this disease returned frequently in the day, and almost every day for several months, and no cause could be discovered sufficient to produce these effects. “ At last excruciating pains
“ in making water overcame the particular

* Mechanical Account of the Non-naturals, &c. p. 14.

“ false delicacy, and obliged her to disclose
“ their source, which was an acrid discharge,
“ excoriating the vagina, proceeding from a
“ diseased uterus.”*

The communications of nerves may be mentioned, as very probably connecting many of the sympathetic associations excited by irritation in these viscera, but I am satisfied with the close analogies of apparent facts, without launching farther into conjecture than experience and observation may justify.

It has appeared in the preceding sections, that Convulsive Asthma is caused by irritation in the lungs of aerial or gross offence. I now appeal to the considerations in the present section, and believe they will support a *General Deduction* from the whole. *Convulsive Asthma is caused by Irritation in some part of the Thoracic, or Abdominal Viscera.*

* Considerations, &c. by Dr. Beddoes and Mr. Watt, Part IV. and V. p. 89.

SECT. XV.

The Consequences of *Convulsive Motions*.—*Convulsive Asthma* remaining after the *Irritation* is removed.—The influence of *Habit*.—*Repetition* of morbid motions, arising from sensation and perceptions of the mind.—*Fever* counteracts the principle of habit.—*Instances* of mental impression operating upon the body and inducing morbid motions.—*Ideas* of relation.—The *Hysteric Asthma*.—*Inference* from the whole..

WHATEVER may be the origin of a convulsive disorder, a certain consequence of repeated exacerbations will be an encreased mobility or sensibility of the moving muscles. Asthma is particularly attended by this inconvenience, which may operate to a renewal of the paroxysm, after the proximate cause

is removed, whether it be embodied in mucus or effluvia irritating the lungs, or in any noxious matter hurting an organ of the lower viscera.

Convulsive Asthma may, therefore, appear in force without any adequate and apparent irritation to excite it. This surprising phenomenon is dependent on original principles by which the animal œconomy is materially regulated, and which may be referred to the influence of *Habit*, and *Perceptions* or *Ideas* of the mind operating upon the motions of the body, connected with habit.

The original motions may probably be excited by *Irritation* only, or that instinctive perception of injury which is immediately followed by the reaction of the system. *Sensation* has been stated to be a distinct property of the living fibre, but it is capable of attending, or being introduced by *Irritation*.

Here we are considering that advanced stage of Asthma, when one paroxysm or more has been sustained. And we are to assent to the position which the preceding considerations have established, that the disease is always occasioned in its first attack by irritation of matter more or less subtle. We must, in fact, grant, that it would not have existed without this immediate cause.

Habit consists in that encreased facility with which a voluntary muscle repeats a motion which it had before performed; and it is owing to habit that a muscle acts so readily with other muscles with which it had been before associated, and that it is called into action by *sensations* which its contractions had before accompanied.*

If irritation, then, excites the *primary* motions, the repetition of these must have some cause, exclusive of habit, which is a predisposition to *secondary* motions.

This cause is *Sensation*, which appears to unite its influence to that of irritation, producing repeated actions, and strengthening the predisposition to them in the following manner.

Every sensation is accompanied by a perception of the mind, and a chain of connected perceptions being called up in the mind, constitutes memory. These perceptions then make parts of the same complex idea, and have, by frequent repetition, a strong relation. Associations of this nature are more or less faithfully preserved, according to the circumstances of repetition of the parts, of the interest they excite, and the habit of the body.

* See Dr. Blane's Croonian Lecture.

Seeing and *Hearing* are exercised in combination with all perceptions, and they become signs of the sensations which excited them. When the memory or imagination renews the ideas of seeing or hearing, they may also renew the perceptions associated with them. With these perceptions are associated their relations; and finally, with these connecting links are renewed pleasure or pain, which had before attached to the sensations: and thus may be reproduced the very emotions of mind, or the muscular contractions of the body, which such sensations had before excited.

In this view, repetition of muscular convulsion is not always obscure in its principles. It has its causes proximate and remote, which, though not material, may excite the morbid motions of animal fibres by the operations of the mind.

The extraordinary recurrence of morbid actions from the primary perception of injury, may therefore readily take place, if pyrexia does not prevent the repetition. In cases of those poisons which produce febrile affections, an insensibility of their future stimulus is

* Vide Professor Cullen's Institutions, LXX. &c.

commonly conferred with the disease,* and becomes established against a second attack, but in cases of organic irritation not producing fever by its specific quality, as in Asthma, the organ will be more susceptible of repetition of motions, the oftener they have been performed; and this from the influence of sensation, as well as very inferior, and seemingly inadequate causes of irritation.

When *Phthisis* has supervened upon Asthma, the purulent fever obliterates the impressions of habit, and the paroxysm of respiratory labour is not preserved in periods. Its actions are found to be calmed, and to subside into moderate dyspnoea.

In conformity to these principles of the animal œconomy, an irritative cause may have disturbed the function of the lungs, or lower viscera, and, by the operations of the system, no longer preserve its seat; but the *motus meditati* of the muscles may return at intervals, though the exciting stimulus is removed. An affection of the mind may have concurred with organic irritation when the paroxysm of Asthma was first produced, and the continuance of such a state of mental impression will

* As in Small Pox and Measles.

render the body still more liable to those muscular contractions which had arose out of material irritation, became catenated with the accidental trains of ideas which circumstances introduced when the body sustained its influence, and which will then be recalled by the force of sensation, the original offence no longer having influence, and the combination with it absolutely dissevered.

Again, pneumonic inflammation may have left an indirect debility of the capillaries of the lungs, which may, for a time, separate an excess of serous fluid in the vesiculæ, but, becoming gradually restored to their contractile tone, this state of the vesiculæ may only for one day have excited the motions which are consequent to the irritation of their cavities. But during this short paroxysm a train of ideas may have been occasioned by the circumstances of the patient, which recurring with violent sensations at intervals, will introduce those animal motions with which they had casually been united at a former visitation.

Asthmatic paroxysms, from such a train of impressions, have taken place in many subjects where convalescence was much advanced, and the primary cause, after a considerate balance of all the circumstances, was not suspected to exist.

Operations of the animal œconomy derived from ordinary causes of greater simplicity will explain the subject more clearly.

The discharge of urine, or alvine feces, is frequently attended with certain ideas, which become linked to the animal motions excited by the stimulus of distention in the hollow muscles of the bladder and intestines. A propensity to these evacuations may afterwards regularly recur at particular periods, when the attendant ideas, excited by time or place, introduce the connected sensations of those discharges; and the abdominal muscles, and diaphragm, and the bladder, are excited to contract and expel the contents, though the stimulus of distention is, in fact, not present, but by habit, not only is the contraction of the external muscles induced by association with connected ideas, but the peristaltic motions are brought to obey the new rule of the œconomy, and urine becomes secreted against the arrival of the period.

The effect of repeated emetics is well known: The stomach is rendered more irritable by the repetition; and the ideas connected with the nausea excited by the medicine, very frequently induce the nausea without its assistance. The sight of a phial, or of

a liquid, with which the emetic operation had been promoted, by raising their correspondent ideas, led to the very impresson of the primary link, and excited the very contractions of muscles which empty the stomach, and still further, the associated contractions of other muscles, which, according to the usages of the animal œconomy, had before acted in combination of effort for other purposes.

The influence of ideas of relation, which circumstances have connected with a particular impresson, is too well ascertained to be doubted. The sensation of terror has induced syncope, or epilepsy, or hysteria. The object which had excited that sensation may not only renew the affection which it induced, whenever its appearance is renewed, but the connected circumstances may induce their correspondent ideas, and the impressions thus linked in the mind by association, will become a train of sensations, the individual parts of which successively introduce each other. When this association is established, the same animal motions may be repeated from apparent dissimilar causes, but these are remote causes of the immediate sensation inducing the disease.

A lady had been thrown into a paroxysm of terror by a footpad, and for the first time sustained a series of hysteric fits. Her constitution became feeble and acutely sensible. The hysteric affection recurred on smaller occasions of alarm for many years afterwards, but more particularly was excited by the renewal of slight circumstances which referred to the attack, though entirely distinct from the outrage. After the interval of three years, during which she had diversified her impressions in a distant neighbourhood, she passed in a carriage along the road, and by the spot where the assault was made, and affected by the chain of ideas and her attention to them, she relapsed into strong convulsions.

A worthy woman had been long subject to dyspeptic complaints and irregular secretions of bile. She married at 25 years of age, and after having been much at her ease, found it at length necessary to employ herself in business, and attend with great care to an increasing family. These attentions happened to create considerable trouble and fatigue on Sundays. On this day she gradually became more and more indisposed with Hemicrania, but on the other six days had her usual health. After the interval of ten years, the head ache was aggravated, and began to affect her

earlier by a few hours, but did not cease sooner than was usual. In this form the intermittent disease continued for several years, evidently excited by the additional anxiety and fatigue of one day in the week.

Her situation was again altered, the day of fatigue became a day of rest, and improvement of circumstances diminished general anxiety. It might be supposed, that the Hemisrania would be lost with the impressions which brought it on, but I am informed that it still regularly recurs at its former periods, being linked with ideas of relation that still arise from external circumstances. It is probable, that a complete change of residence, and losing the impressions of Sunday, or placing them in another day, might vanquish the force of habit, which is only now supported by perceptions connected with original sensations.

The case of Hysterical Asthma in Floyer,* was probably introduced by sympathy of the respiratory muscles, with that disorder of the stomach which so frequently takes place from strong affections of the mind. Affliction, at the critical age of fourteen, threw the lady into hysteria. Dyspepsia accompanied her

* Floyer, p. 17.

agitation of mind, and the acrimony of the first passages which naturally follows the disturbance of digestion, would stimulate the coats of the stomach; that viscus would be distended with flatus and impede the descent of the diaphragm. The branches of the eighth pair of nerves would communicate sensations of inconvenience to the pulmonary system, and the muscles subservient to its function were drawn into association, and a paroxysm of Asthma was formed.

It is not difficult to conceive, that these contractions of the respiratory muscles may be subject to recur, when the habit of their associations had been once established. Slight causes of organic irritation might draw on the convulsive efforts, fruitless, but in consistency with the laws of animal life. The same trains of ideas, which in the first attack of hysteria, had met with a particular condition of the uterus at the age of 14, and combined at that period to bring on the convulsive affection of the stomach, œsophagus, and respiratory muscles, would occasionally revive on future accidents, and be followed by the catenated motions to which habit and repetition would contribute facility.

Thus are many causes apparently lost, though their effects are continued in the

diseases which they produced. Habit, or the frequent repetition of morbid motions rendering the body liable to a more ready recurrence of those motions, according as the ideas annexed to them, by surrounding circumstances, lead to the sensation which is the primary cause. The revolutions of seasons, the diurnal changes of day and night, the hours of rest and activity, the hours of meals, the objects of pleasure or pain, the connections of friendship, or business, become united with the motions of the mind, and body, and thus associated, morbid actions are revived, according to their situation in the general chain of links.

All this is well known, but like many other parts of knowledge, the result of common observation, the impression has been superficial, and too much neglected in practice.*

But all physicians have acknowledged the strength of indications afforded by habit in the disease of chin-cough. Here every part of the usual plan of life and diet, is directed to be changed. A new air is particularly requisite, without attention to the

* In Zoonomia, there are rules by which the influence of mind on the actions of the body, are to be ascertained, with greater precision, than could be expected in so obscure a subject.

standard of its purity; and by thus counter-acting the former perceptions, the disease will frequently vanish without the continuance of medicine.

In epilepsy, a disease observing periods, like Asthma, Hippocrates directs a total change in the manner of life, that former habits may lose their influence.

In Asthma, if in any disorder, a similar alteration ought to be enforced, and, as will appear in the practice, the judgement of the Physician will be defended by the event.

We have now taken a view of Asthma, under all the forms in which it has been said to appear. We shall obtain a more distinct direction to a cure of the disorder, if a new arrangement of species is set out on the basis of inferences from this Inquiry. A plan which I propose with greater confidence, because I can experimentally affirm, that indications arising from each species, are really answered with success in practice, and if they are followed with attention, Convulsive Asthma will not be included, any longer, in the list of *Incurable Diseases*.

DISORDERED RESPIRATION unattended by Fever, may be divided into ASTHMA, *Continued* and *Periodic*.

Continued Asthma can not properly be said to be free from Convulsive Contractions of the respiratory muscles, but these are carried on without regular paroxysms. They are more permanent but less violent, and depend upon fixed Irritation, Abdominal or Thoracic.

Periodic Asthma, discovered in regular paroxysms of more acute energy, and therefore usually called *Convulsive*, which term we adopt as describing its character, and still complying with general custom.

CONVULSIVE ASTHMA:

1st Species, from Pulmonic Irritation of Effused Serum.

2nd Species, from Pulmonic Irritation of Aerial Acrimony.

3rd Species, from Abdominal Irritation in the Stomach, Uterus, or other Viscera.

4th Species, Secondary and dependent upon *Habit*, after Irritation is removed from the Thoracic, or Abdominal Viscera.

These are the Species to which I shall refer, in the last part of this *Practical Inquiry*.



Practical Inquiry

ON

DISORDERED RESPIRATION.

PART III.

Practical Paper

WATERBURY, VERMONT

PART III.

The PRACTICE in ASTHMA.

SECT. XVI.

*The Cure of Convulsive Asthma attempted.—
Indications arising from the distinctions of
species.—The Paroxysm, including exacerbations.—
In what the cure of Asthma consists.—
Remedies tried.—Cathartics.—Emetics.—
Diaphoretics.—Bleedings.—Diuretics.—Is-
sues.—Antispasmodics.—Expectorants.—
Blisters.—Inhaling of Vapours.—Oxygen.—
Hydrogen.—Stomachics.—Absorbents.—
Stimulants.—Bathing—Tonics.*

AFTER a full consideration of the preceding sections, and the comprehensive inductions which they afford, it will not be expected that, in attempting the cure of Asthma, I shall confine myself to the lines which have been marked out on hypothetical grounds by former writers.

A Professor, who directed the opinions which still influence the practice of medicine, and whose authority concentrates the theories, real or supposed, of former teachers, exhibits no encouraging aspect to cheer the expectant pupil, or confirm the experienced student in the truth of the assigned cause of this disease.

“As it is seldom,” says Dr. Cullen, “that an Asthma has been entirely cured, I therefore cannot propose any method of cure which experience has approved as generally successful.” He, however, states the disease “to admit of alleviation in several respects from the use of remedies, and he makes it his business to offer some remarks upon the choice and use of the remedies which have been commonly employed in cases of Asthma.”*

Cullen particularly attended to the authority of Floyer, adapting the theories of that author, as well as he could, to the pattern of orthodox, which he proposed to establish in the schools of medicine, and forcing the system of Willis to conform itself to the fashion which he adopted.

But was the extraordinary success of Floyer, in treating the disease the inducement

* Cullen's Practice, MCCCCLXXXVII.

which influenced the professor? It is not to be supposed, that after complaining of the tyranny of the Asthma in his own person for thirty years, Floyer could attract a conviction of the truth of his theory, or much applause for the success of his practice.

It is time that other indications should be pursued than those of relieving spasmodic constrictions of the bronchia and effervescences of the blood, or let us rather become empirics, and take the chance of benefit from casual experiment, and the happy success of blunder, than rely on directions which confessedly do not point to the object of our wishes, and may possibly lead us to error.

The author of this Inquiry had, unfortunately, a very particular inducement to obtain light in the treatment of Asthma. He was himself the object of its attacks, and might possibly have had a prospect of complaining as long as Floyer did of its tyranny, if a determined resolution to deviate from the common path of practice had not occasionally yielded instruction, and given a basis for further experiment. In this progress, the *Juvantia* and *Lædientia*, elucidated, in an important degree, the indications which were before obscurely seen. He was, however, in the course of these

trials, too often the victim of ill founded theories, to give credit to the pathology which they supported. Despair on the one side was succeeded by more animating prospects on the other, and he can finally affirm, that the doctrines arranged in the preceeding sections, were digested from conviction of experience in the effect of remedies, as well as from primary or secondary indications afforded by the phænomena, and a careful comparison of analogies.

He had observed the serous effusion in the vesiculæ of an Asthmatic in the year 1786, but he was not led to a conclusion of the disease being occasioned by irritation of that kind in general instances, till personal inconvenience, arising from the disorder, had excited him to examine the forms of it under all circumstances and every influence. He was impressed by the salutary caution which Celsus gives of not mistaking effects for causes, and had not previously reflected on the degrees in which effusion might take place, but considered the appearance as evidence only of the termination of a violent disorder, and the immediate occasion of death.

At length a further consideration of this dissection, which he had recorded, prompted

him to act with more decision in opposing the predisposition by tonic medicines. He afterwards extended his inference from this evidence, and having the alliance of analogy and the laws of animal life, he took the convulsive contractions for indications of this irritating offence, which he found might exist in more or less quantity, according to the extent and prevalence of remote causes.

His satisfaction was still more perfect, when he afterwards found that the same *principle* of irritation might occasion the disorder in species of Asthma where mucus did not appear, and when practice continued to answer with great success to the indications which he had consulted. I may, therefore, claim, in favor of the doctrines of the preceding sections, the support of practical authority, and I shall endeavour to condense the remainder of this inquiry as closely as I can, requesting the reader to consider the inferences and species proposed in the former part, as marks to guide his medical walk, which have not been set up without mature attention to the force of remedies which they naturally point out in Asthma.

From the year 1787, I have examined the forms of Asthma with increased industry,

and have been supplied with more numerous opportunities of trying the force of remedies in the paroxysm, than can generally occur in a practice of ten years, where the motives for inquiry are less personal to the physician.

I have, in consequence, a collection of experiments, made in 130 paroxysms, which, unless I could discern the advantage of a particular detail, I consider too numerous to introduce here. The reader will be better satisfied by a general account of success where it has been found.

A Paroxysm of Convulsive Asthma, is that state of the disease which has an *Exacerbation* at night as long as it lasts. When the intermission takes place, Asthma is not cured, and though the paroxysm is generally attended by at least *Three Exacerbations*, it sometimes is extended through many more, nor is there any certain limit to their number. If it does not embrace so many as three, benefit may be said to be derived from some operation of art or nature, when the patient has a confirmed predisposition to the disorder, but we can never assent to the propriety of claiming an advantage over the paroxysm, if the exacerbations are renewed as often as

was customary in former fits, or oftener than three times if the disease is new. Much less can the word *Cure* be admitted to close the physician's labour, or enhance the character of his sagacity, unless an entire change in the habit of his patient, comprehending vigorous digestion, and easy respiration, should be well established after the paroxysm has been long overcome.

The cure of the Convulsive Asthma is, therefore, to be only attempted with success, during the intervals of the fits. But the paroxysm may be alleviated, and whoever has experienced its agony, will allow the value of the smallest improvement in treating it.

We shall cursorily notice different remedies proposed or tried in Asthma, pointing out the treatment which may most generally be adopted to relieve or shorten the paroxysm. And afterwards recommend, upon experience, a plan of *Cure*, which may be illustrated by a few examples, assigned to the several species of the disease.

CATHARTICS, considered generally, are injurious in cases of Convulsive Asthma, from irritation in the lungs. If this class of medicine is ever useful, it must be in that spe-

cies in which the irritation is seated in the first passages, but even here, the practitioner must not forget the predisposition to every form of this disease, in which laxity of fibre, or morbid sensibility are predominant. There may be complicated cases in which a mixture of symptoms leaves the propriety of purging in more doubt. But there are instances of purging bringing on a paroxysm, and we can, therefore, not recommend any evacuation but the mildest, with the intent of discharging the corrupted remains of indigested matters from the first passages.

Purging has been suggested as a means of promoting absorption : if ever it can be employed in this intention, without inducing greater inconvenience than it will remove, the state must be that of Dyspnœa, when the vessels are turgid, but have not yet relieved themselves by serous effusion: This state comes nearest to the second species of Convulsive Asthma, but in this I have not seen purging of any advantage.

A bolus, composed of Calomel gr. iii. Antimon. Tartarifat. gr. i. Pulv. Jalapii gr. xx. was taken when the *terrentia* of the paroxysm had made their attack. And a simi-

lar medicine was taken in another paroxysm in the height of an exacerbation, by the author, who was affected with Convulsive Asthma of the first species. The paroxysm was not suspended or alleviated in either instance, but it was certainly prolonged in the last.

EMETICS.—Immediate relief has been given by vomiting, and this happens generally in cases of Asthma wherever the irritation may exist. But it is particularly useful when the first passages are loaded with indigested matter, so frequently exciting the paroxysm in the first species, or acting as the immediate cause of it in the third.

Nauseating doses of emetics are advantageous in the three first species, as they determine the fluids to the surface of the body, and relieve the lungs or abdominal viscera; they promote absorption of extravasated serum, and exhalation from the lungs, and are powerful expectorants.

Etmuller and Baglivi recommend vomits, and Floyer approves of the operation once a month; but a repetition at regular periods is to be condemned, if the physician does not desire to introduce into the habit a new rule of secretion.

Other writers oppose emetics as dangerous in the paroxysm, but violent vomiting is not suggested, and the gentler motions of nausea with slight puking, are more likely to determine from the lungs, than to encrease the flow of humours to that organ, as is very justly enforced by Dr. Foart Simmons, in treating of Phthisis.

If the subject is uncommonly vigorous for an Asthmatic, and occasionally in the second species of the complaint, tartar emetic, or antimonial wine may be given. In other cases, small doses of ipecac. are to be preferred. I have, in several instances, excited strong vomiting at the approach of the fit. R. B. took five grains of Tartarised Antimony when the paroxysm had just commenced. After violent evacuations upwards and downwards, with great present distress, the paroxysm was lengthened by several exacerbations more than he before sustained. Greater weakness in the intermission, and night sweats, were, besides, the consequence for several days.

DIAPHORETICS.—Neutral saline medicines are given with advantage during the fit of the first species, and also of the second. In the third species they are often useful.

In the last they are manifestly hurtful.—Whenever they are used, the intention is to promote a gentle diaphoresis, but not sweating, which is always injurious, and particularly so if forced by heating sudorifics.

BLEEDING.—Many doubts occur on the propriety of bleeding in Asthma, in any species of the disease. Before the pulmonary vessels have attempted to relieve themselves by their exhaling orifices, blood may possibly be drawn with advantage, but when effusion has taken place, a certain debility is indicated, and a loss of contractile power in the coats of the vessels, which prudence will rather submit to during the fit, and attempt to remedy in the intermission. In this state of the disease, nature pursues the path best adapted to her circumstances; the escape of serous fluid gradually relieves the vessels, and respiration and absorption must be relied on, with a salutary cough, to clear the air cells of the lymph. If evacuations of blood are directed, the sudden depletion of the vessels will leave their coats without the stimulus necessary to produce a contraction, equal to the space which the blood had occupied; the heart will participate in the injury, and will also be deficient

in vigour of contraction. If, therefore, blood is to be taken, it should be drawn from the vessels at intervals, and in small portions, which would allow of the contractile power being exerted, in proportion as the vessel loses its contents, and would not finally take so much fluid away, as would leave it without the stimulus of distention, so essential to its return of health.

But bleeding is an imprudent operation in every species of Asthma, unless it be the second. In the first species I have repeatedly directed it, but have never had reason to think that the paroxysm was shortened an hour by the loss of blood, and I have often been convinced that expectoration was delayed, and more dyspnoea remained in the intermission, than was common after former paroxysms. In old people who have been used to the disorder, it is certainly injurious. In the second species there are occasional topical inflammations, which this operation may relieve, but if it is carried far, there is the strongest reason to apprehend, that the patient may be plunged into Asthma of the first species.

I believe bleeding has never been suggested as proper, during the intermission of uncomplicated Asthma.

DIURETICS.—Whether the great flow of watery urine from the kidneys is a critical discharge to relieve the lungs in the first species of Asthma, or not, I have never seen the paroxysm shortened by encreasing it. The diabetes is also a symptom in the third species, and can be explained only from the state of the first passages, which has been described.*

Notwithstanding these doubts, diuretics have been recommended in Asthma by physicians, antient and modern. Celsus† says, “profunt etiam, quæcunque urinam movent.”

Hoffman’s opinion is thus explained “In statu cachectico, cui jungitur Asthma mag-
“nam opem ferre deprehenduntur diure-
“tica.”‡ Rhodius§ asserts, that after the speedy discharge of thirty-seven pints of urine, the disease was cured. Baglivi says, “pluries adnotavimus, in pectoris morbis,
“semper ducendum esse ad vias urinæ, natu-
“ra id monstrante.¶

“As diuretics and quicksilver,” says a writer of ingenuity, “have been famed for
“their service in the Asthma, have we not

* Sect. X. † Celsus, Lib. IV. Cap. 4.

‡ Tom. III. Sect. II. Cap. 2. § Lib. III. Obs. 27.

¶ Baglivi, Obs. p. 103.

“ reason to suspect that an anasarca, so obsequious to these remedies, is often the foundation of the Asthma.”*

Floyer says swelled legs and copious urine are beneficial changes in the Asthma.

Whatever species of Asthma may be alluded to in these accounts of benefit from diuretics, I cannot think that any critical discharge is so useful as by expectoration in the first species. And we are to avoid impeding that event when diuretics are given; squill and vinegar coincide in both intentions.

In experiments with digitalis, I have proceeded to a dose which induced symptoms well known by practitioners to mark the propriety of discontinuing its use, but I have not seen benefit from the exhibition. The general tone of the body is not sufficiently low to admit of efficacy from this powerful herb, and expectoration would be impeded by its active operation.

If urine is small in quantity and high coloured, saline diuretics should be given, and mercurials are also then usefully combined, as the case is probably complicated with visceral obstructions.

* Edin. Med. Essays. Vol. II. p. 326.

ISSUES.—The antients had always in view the serous defluxions in this disorder, and endeavoured to intercept them descending from the head. This was the indication followed in the cruel practice of *Ætius*, who had so little ceremony in using the cautery, as to direct fourteen ulcers to be made and kept open at once, between the head and the diaphragm.

In very old Asthmatics, issues are sometimes necessary. When the disease is not inveterate, they may occasionally be useful, by diverting aqueous humour from the lungs, and giving a better opportunity for the operation of tonic remedies.

When the disease is complicated with general dropfy, I have seen great advantage to the breathing, from their application in the thighs.

ANTISPASMODICS.—Antispasmodic medicines have no certain efficacy in shortening the paroxysm of the first species of this disease. Exceptions may be made to this general remark, but they are not founded upon precise lines of distinction of the different species.

In the fourth species, which often appears in Asthmatics, who may also be subjected to exciting causes, occasioning one or other of

the three former, antispasmodics will not deceive the physician. Opium stands first, but its value is frequently enhanced by the addition of Æther. If these valuable medicines had been applied with proper discrimination of different species of Asthma, the practice would not have been so frequently disgraced by failure in the expectations of relief from their uses.

Calcined Zinc, which has been strongly recommended, has been found in many trials perfectly inert and useless in the paroxysm. And yet the antispasmodic powers of this mineral have been proved in epilepsy, and the opinion of Gaubius on its virtues has been justified by the experience of many other physicians. If it is used in Asthma, it can be only as a means of counteracting the habit of convulsion discovered in the fourth species.

In the intention of removing spasmodic constriction, a numerous list of antispasmodics have been tried, singly and in combination, in the first species of Asthma, with little advantage. Valerian, cardamine, camphor, musk, castor, beladonna, tobacco infusion, extract of henbane, fetid gums, cuprum ammoniacale

have been given in various doses, more or less complicated with other antispasmodic or tonic medicines, and combined with opium in large and small portions; but where mucus was to be expectorated, the paroxysm was not suspended, but frequently prolonged. In the dry Asthma (second species) I have not made so many trials, but I can affirm, that no antispasmodic is so useful in the beginning as nauseating doses of ipecac. with diaphoretics, in the cases which I have had an opportunity of treating.

In the access of a paroxysm of the first species, R. B. took four grains of solid opium; which produced nearly an apoplectic stupor for two days. After a few hours, the most debilitating sickness came on, with incessant efforts to puke. The labour of the respiratory muscles was abated, but the wheezing evidently increased; a countenance more turgid than usual, and intense head ache attended. The pulse was increased in strength and quickness for a few hours, but then sunk into great weakness.

The paroxysm shewed itself four hours earlier than usual the next day, and two grains more were taken when it was perceived to commence; respiratory labour seem-

ed again to abate, but the anxiety encreased to an alarming degree, as the stupor became something less. The pulse was now weaker, and frequently irregular. Loose motions succeeded and a general sweat. The energy of the paroxysm then revived with exquisite distress. A medical friend, who attended with great care to the progress of these trials, became alarmed, and endeavoured to promote puking, without effect. Blisters were applied, and draughts of vinegar and pepper were given, interposed with strong coffee and mustard. The patient was at last brought back to a state more usual in former paroxysms, but with every care, the exacerbations were no fewer than nine, before expectoration becoming gradually more copious, concluded the fit. Notwithstanding the bad success of this experiment, opium gr. ii. was used in another paroxysm after an active vomit, and bad consequences still ensued, though not so extensive. In the latter experiment, the extraordinary symptom of a most painful strangury came on, which continued several hours.

Extract of henbane was substituted for opium, in succeeding trials, but with no better success in the beginning or height of the paroxysm. In the second species this narco-

tic produced rest when opium would not, but though the exacerbation was disturbed, the paroxysm was not shortened.

Musk was given twice to a patient in the first species, in doses of half a dram each. A perspiration came out, but the anxiety and laborious respiration were not lessened.—Camphor being added in equal quantity, heat was much encreased, with violent head ache, pain in the stomach, and spastic twitchings in the intercostal muscles, but no relief to the breath. Plentiful dilution was used, and the extraordinary symptoms subsided. Camphor was joined with foetid gums, in many instances without advantage, and where dyspepsia was very predominant, these complicated forms always encreased the disorder of the first passages.

It is in the fourth species, that antispasmodics are given with decisive effect, and I have little doubt of their general advantage, when that state of Asthma can be ascertained to be established. Vinegar, cordials and volatiles may be combined frequently with narcotics, but the stinking gums disorder digestion, and also promote purging, which is not desirable.

Opium and Æther are the most valuable of the class in this species, and their dose

must be proportioned to the necessity of the case. The judicious practitioner will frequently exhibit them in small doses, with as good an effect as from large ones, and will remember that a gigantic instrument applied unnecessarily, may create gigantic fame without much estimable reputation attached to it.

Opiates are occasionally useful after emetics and aperients, in any species of this disorder.

EXPECTORANTS.—These are a class of medicines useful in the first species of Convulsive Asthma, in proportion as they are indicated. All practitioners are convinced of the necessity of applying them. Myrrh is certainly not an expectorant, however valuable as a stomachic. It has been of no use during the paroxysm.

Ammoniac is a very valuable expectorant, but more so, if united with a saline menstruum. A composition of this kind, is, however, likely to purge, if not prevented by opium. This gum alone, is too heating, and Assafoetida, which has been much recommended by Dr. Miller, is more so. He found it most beneficial when it puked the

patient. His disease is not determined to have been the Convulsive Asthma of adults, and the good effects which are described, have never resulted from its use under my direction. It is also materially inconvenient to persons who cannot be contented with a constant foetor in the mouth, alvine discharges, and the air of the chamber.

The oily and demulcent expectorants, are not calculated for any species of Asthma; the stomach of an Asthmatic is sufficiently disordered without their additions.

Squills are very useful in the two first species of the disease. When united with vinegar, we obtain the medicine on which Floyer bestows the greatest applause. In many trials with vinegar of squills, I have seen great advantages from its exhibition, in the first species of Convulsive Asthma. It is most useful at the commencement of the paroxysm, and proportionably so, as it is attended with some little nausea without diarrhæa. However much it may promote urine, this effect seems not to shorten the paroxysm of Asthma, whilst its other powers have prepared the way for expectoration, and probably excited absorption.

Vinegar of squills is also a good medicine in the second species, but I have remarked, that its power over the paroxysm is then only in proportion to its emetic, or nauseating effect. In the third species, unless it vomits, I can see no use in the exhibition.

Oxymel is only efficacious, as it contains vinegar or squill. Honey or sugar are too fermentable for any species of Asthma, and frequently impede the operation of better medicines.

Decoction of feneka is useful in the Asthma of old people, but in the paroxysm of younger persons, I have found it too heating.

All expectorants of heating qualities are improper in Asthma, unless by combination with other ingredients these qualities are corrected, and it should be recollected in their exhibition, that the state of the stomach requires amendment. Nauseating doses will not exactly coincide in both intentions, but the effect of nausea will be a gradual removal of the offensive matters, which will be passed forward from the duodenum, and absorbents, with bitters and expectorants, may then be pursued with greater advantage.

Blisters between the shoulders, are not of decisive use. Their application is generally

accompanied by medicines which may promote expectoration without them, and the usual length of the paroxysm is not diminished. When applied to the pit of the stomach, I have frequently thought the distention of that organ lessened, and breathing has been more free. Expectoration has not, in my opinion, been clearly promoted by an application of blisters to any part, in the paroxysm of Convulsive Asthma.

INHALING VAPOURS.—Hippocrates claims the honour of introducing the inhalation of fumes from various herbs, and resinous gums. He used herbs and nitre boiled with vinegar and oil, and directed the vapour of such boiling compositions, to be drawn into the lungs through a proper pipe. This practice was extended in many directions, and upon various indications of disease, as may be found in many parts of his works.

Upon the indication of excess of serum, fumes were directed to be inhaled by practitioners, many ages after his time, for the purpose of drying the moisture which was the cause of Asthma, and also to carry off the remains of the obstructing matter. Frankincense,

myrrh, and many other gums, were in common use, with which arsenic was occasionally mixed with dangerous and injudicious boldness. But this application of the mineral, arose from the mistake of taking the gum juniper or vernix of the Arabians, which, by their medical authors, was prescribed in fumigation, under the name of sandarac, for the *σανδαράχη* of the Greeks, which doubtless was an arsenical mineral.*

Inhaling of fumes has been suggested by modern physicians both in Phthisis and Asthma. The vapour of Æther, raised in the steam of warm water, has been often inhaled from the instrument recommended by Mr. Mudge, but without advantage in Asthma. In the first species, the symptoms were aggravated, as we may presume, from the greater rarefaction of the air contained in the lungs, and the more considerable expansion of the fluids in the pulmonary vessels.

The inefficacy of æthereal vapour in Asthma, may be anticipated by considering the advantage of inspiring it in phthisis, a disease of contrary indications: In which it

* Vide Galen, Lib. IX.

is recommended by Dr. Pearson, with the impregnation of cicuta. The vapour arising from hemlock leaves only, infused in boiling water, was once found serviceable in the second species of Asthma, but always injurious in the first. In the last kind, its narcotic quality may be supposed to recommend its use, but antispasmodics directly taken into the stomach, will act with more decision, and render other means unnecessary. If there are virtues in some herbs, calculated to promote expectoration, the vehicle of aqueous vapour is not favorable to their operation; heat and moisture conveyed into the lungs, being more likely to encrease the disease than to give relief.

Smoking Tobacco is practised by some Asthmatics; who mistake the great excretion of saliva for a necessary evacuation. I am satisfied that a much more copious determination of lymph is made to the bronchia and salivary glands, by smoking, and it is entirely conformable to the actions of the œconomy, if the habit of such serous secretion becomes established, though this exciting cause be absent. I have persuaded some Asthmatics to abandon the practice, with

great advantage, in the first species. The atmosphere cannot supply the necessary demands for oxygen, sufficiently fast in the paroxysm, even if the impurity of tobacco fumes is absent.

Oxygen, Hydrogen, Hydro-Carbonate.—Those who are best acquainted with pneumatic medicine, speak in sanguine terms of the effect of oxygen in Asthma. “No sooner does it touch the lungs,” says Dr. Beddoes, “than the livid colour of the countenance disappears, the laborious respiration ceases, and the functions of all the thoracic organs go on easily and pleasantly again.”

Many authorities confirm the fact of benefit being derived from the inspiration of this air in Asthma, but as there has been little distinction of causes, marking its species, pneumatic medicine has been tried from random indications, and hydro-carbonate and hydrogen are said to be useful in Asthma, as well as oxygen, though their properties are so different. Dr. Ferriar gives us an account of undoubted benefit, from the use of hydrogen in Spasmodic Asthma, but the disease is said to have taken place after inflammations in the thorax and adhesions of the plura; it

should, therefore, be included in the continued species, from fixed causes. In a case of this kind, oxygen would probably revive pain and inflammation, from its stimulating properties, opposite to those of hydrogen, which last could not be a permanent remedy.

In the first species of Convulsive Asthma, I have no doubt of the advantage of using oxygen in the paroxysm, and I am not less hopeless of a perfect cure from the continuance of this remedy only in the intermission, though here too, it will aid the general means.

I am well acquainted with the return of the paroxysm in two instances, after the most favorable expectations being entertained, from the relief afforded in paroxysms of the disorder.

In the second species of Asthma, I am informed by a physician of great accuracy and discernment, oxygen has appeared hurtful, encreasing heat, anxiety, and even producing temporary fever, when the pulse was previously under 90. Hydrogen and hydro-carbonate were tried without benefit, and the fit vanished by moving out of town.*

* I am obliged to Dr. Thomas Bree, for many trials of aerial medicines in Asthma.

In the third species, where the first passages were affected with dyspepsia, and the greatest debility, oxygen was usefully inhaled, though I cannot say what length of time was requisite to produce the good effect; I am only informed that a patient "affected with convulsive paroxysms, belonging to this species, enjoyed a better appetite, and suffered less in the paroxysm, after the inspiration of oxygen, as recommended by Dr. Beddoes, than he was used to do."

It is not always possible to ascertain if irritation of serum was absent from the lungs in this species, when great acrimony offended the first passages, and had most influence in exciting the fit. But if oxygen is really a remedy for dyspepsia, it may be useful in this species, by invigorating the arterial and absorbent systems, and thus eventually promoting peristaltic action, and a better assimilation of alimentary matter. It has been rendered probable by M. Hallé, that oxygen is principally instrumental in performing those combinations in the intestinal canal by which assimilation is produced.*

That it is useful in the paroxysm of Asthma, from irritation of mucus, may be de-

* See La Médecine Eclairée, &c. par M. Fourcroy.

duced from a consideration of every circumstance of predisposition to the disease, and still more from the positive cause of the fit.

Oxygen is a stimulating fluid, which being inspired, may act directly upon the capillary orifices, and excite them to contract their apertures, and preclude the further exit of their contents. If its exciting qualities were to be applied to the arterial trunks only, they might propel the blood with unusual force, and the capillary extremities not being equally excited, the disease might be more advanced: but in speaking of this diffusible and subtle fluid, we cannot adapt the reasoning which would apply to other powers operating upon the œconomy of life; we are to consider that it is a necessary constituent of the blood in its healthy state, and we have facts to depend upon, which prove its salutary force in appeasing the distress of a paroxysm of Convulsive Asthma.

We are also to consider that it may be made to penetrate more extensively, and deeply, into the air cavities, by artificially inspiring it in greater proportion than can be afforded by a common atmosphere, so that the points of vascular texture, uncovered by mucus, and not yet involved in serum, may

be exposed to a greater influence if they are fewer in number.

Its application gives to the pulmonary vessels, and the heart itself, that invigorating impulse which sends the blood to the left ventricle, and the anxiety and straitness, are in proportion diminished : but it is carefully to be remarked, that expectoration still terminates the fit, in greater or less proportion in the first species, which comprehends so large a majority of the cases of Convulsive Asthma. See Sect. X. for additional reflections upon its use.*

As oxygen is a natural unaltered constituent of the blood, the shortest passage to its union with that fluid is the best. When it is inspired the blood receives a supply as necessary as that of new chyle. Assimilation takes place by chemical decomposition of atmospheric air in the lungs, when the supply of *oxygen* is received, and by decomposition of particles of gross matter, when *chyle* is to be obtained ; and as the lungs are a digesting organ, as well as the intestinal tube, so they are also an emunctory for discharge of feces, as well as the bowels, as appears

* See the Revd. Mr. Townshend's Guide to Health, Vol. I. for additional evidence of the use of oxygen in Asthma.

from the constant necessity of exhaling carbon and vapour, and from the carbonated mucus which Asthmatics, whose blood is morbidly replete with fecal parts, so commonly expectorate.

STOMACHICS.—These remedies are absolutely necessary in Asthma, to correct the predisposing dyspepsia, in the paroxysm. Bitter tinctures are not to be used, but testaceous powders are generally beneficial. Acetous acid is particularly grateful to the stomach, and appears to correct the tendency to fermentation, at the same time that it excites absorbing action, and invigorates the organ. It is obvious that cretaceous powders should not be exhibited at the same time, but it is fully confirmed by experience, that both eminently counteract the flatulence and distention.

Additions of stimulant, or heating properties, are out of place until the third day, when the patient usually begins to mend in the first species.

Generally speaking, after the third day of the paroxysm, any particular bitter, or cordial stomachic, must be very destitute of power, if it does not prove useful in all species of simple Asthma.

The mixture proposed by Dr. Griffiths, and Dr. Percival, of myrrh, kali, and vitriolated iron, is a stomachic, of great use when the predisposition of Asthma is to be cured.

Vinegar is the most useful medicine in the paroxysm of the first species, which I have tried. In the access of the fit it may be united with squill, ipecac. or emetic tartar. Afterwards, according to the progress, æther may be added in the first and the third species, in the second it is too heating. When opium is given, it should be united with this acid. Of nitre, in combination with vinegar, I have great hopes, but cannot speak with any decision.

Vinegar would have been found much more useful than it has appeared to be in this disorder, if it had been less combined with saccharine and acescent substances. I have seen the paroxysm, in many cases of the first species, relieved by vinegar, simply united with water, when oxymel was useless or injurious.

The effect of this acid upon the lips, which it renders pale and shrivelled, seems to indicate a quality stimulating the ab-

forcing vessels to increased action, and it is thus that its operation in Asthma is probably to be explained: there may be other reasons given for its good effects, but not so clearly established.

M. Achard,* found by experiment, that vinegar, of all solid or fluid perfumes, phlogisticated the air the least.

It is very obvious, that the professors of pneumatic medicine, will find in its virtues additional proof of the truth of their discoveries. I assert its good effects in Convulsive Asthma, but am not qualified to speak of its *modus operandi*.

The use of Chalk in Asthma seems to arise from the great disorder in the secretions of the first passages. I conclude, that the capillary orifices of the stomach pour out a fluid in too great quantity, and the coats of the stomach being morbidly relaxed, the secreted juices require correcting, not less than the secretory vessels demand some appropriate astringent to excite their contractions. Whether chalk answers this purpose or not, it is as advantageous in Asthma of the two first species, and occasionally in the second, as it is in diarrhæa.

* See Journal de Physique, par M. L'Abbé Rosier, Tome 26.

It has not, however, been generally the practice to use absorbents, because practitioners have hitherto merely looked at obscure sensations of difficult breathing, without referring the natural indications which the phenomena afford to their true causes.

In Asthma of the third species chalk has admirable effects; it should be first given in a neutralized draught, after a gentle puke. Rhubarb should be interposed, and after two days opium being added, will sometimes prevent another exacerbation. I have even seen this effect produced on the second day, but not without a previous evacuation from the first passages, and a very free use of chalk.

STIMULANTS.—The stimulants which have been introduced into practice, within these few years, with such profuse disregard of the ability of the patient to bear them, have been applied in all species, and all stages of Asthma. In the paroxysm of every species in which the irritation is not discharged, their exhibition has frequently done mischief, and not uncommonly induced a necessity of bleeding, which has been falsely referred to the natural indications of the disorder.

Practitioners, entitled by their experience, to call out in the words of the Roman Poet; “*parce, puer, stimulis,*” have been sometimes seduced into these methods, but the injury of early rashness is probably compensated by the comprehensive field of reflection, which is opened to the observing physician. An ignorant, or a thoughtless man, may not readily be corrected, and led back to paths of more security to his character, and the choice of a better judgement. The considerate student will make the *nocentia* the most important part of his instructive lessons, and draw from them his best resources of practice.

I have never yet seen æther give ease in the acmé of the paroxysm of Convulsive Asthma of the first species. In many trials the anxiety and the energy of respiratory labour were certainly encreased. If the irritation arose from repelled gout, the case is more susceptible of benefit from its use, but this case should be distinguished from those of disorders in the alimentary passages, which excite the paroxysm in the third species.

The acrimony of indigested aliment, offending the stomach and duodenum, have certainly produced, in some subjects, the reaction of the system in a paroxysm of Asthma,

but here saline absorbents are infinitely to be preferred, to the hot and stimulant draughts of volatile salts, æther, and stinking gums, the bad effect of which, is too often only diminished, by the rhubarb or aloes which are fortunately united in the composition.

In the paroxysm of Convulsive Asthma, a writer of great authority recommends æther by tea spoonfuls, three or four times, to which he adds ten drops of laudanum. We have likewise a summary direction to apply a blister, to give an emetic, and to bleed. It is difficult to say, what natural symptoms can indicate such contrary remedies, and we can only be satisfied, by reflecting, that Convulsive Asthma has never yet been referred to its distinct and characteristic causes, and that the indications have in some species called for one plan, but in another precluded its adoption.

But though stimulants are misplaced in the paroxysm of three species of Convulsive Asthma, they may be used with advantage in the fourth, if joined with opium, and possibly other narcotics.

They are also occasionally beneficial in the intermission of the first and third species, as a means of exciting digestion, and the

general powers of the habit, particularly the absorbing system. The intention in which they are to be given will determine the physician in his choice.

BATHING.—Warm bathing is hurtful in every species of Asthma. Not contented with probability, R. B. went into the hot bath both in the intermission and the paroxysm. The respiratory distress was much aggravated by the trial in the last state, and the paroxysm was excited in a few hours, and at an unusual period by the trial being made in the former.

The cold bath has been recommended by Dr. Ryan, in Asthma. I believe there is no single remedy of more value in all species of the complaint, during the absence of the paroxysm. I can assert this upon numerous trials of its efficacy.

In the paroxysm, R. B. went into a bath of forty-six of Fahrenheit. It required some firmness to make the attempt, and more patience to bear the ill success of it. The great abstraction of heat was evidently injurious, and it was some hours before the impression was so far overcome, as to take away fears of the consequence.

It will still be doubtful to some persons, if cold bathing is not advantageous in the paroxysm. I give my opinion upon trials made in very acute distress, and leave it to consideration. When the patient has only dyspnœa, he will perceive from its use internal vigour, and have sensations which seem to apply to the removal of predisposing laxity of vascular fibres, from the greater stimulus after the abstraction of a certain quantity of common heat, and by this means the cure is always to be attempted.

TONICS.—Tonic medicines, if we separate a class of stomachics from this general head, are not expected to be useful in the paroxysm of Asthma. They have been applied partially, and abandoned capriciously, by most practitioners, in cases of Asthma during the intervals.

But a desideratum has always been a proper distinction of specific causes. If tonics are given in cases of disordered respiration arising from secret vomicæ, small tubercles, adhesions of the pleura, and many other causes of Continued Asthma, what consequence can be expected, but encrease of disease, and accumulated mischief? The re-

collection of every practitioner will enable him to allow, that instances of this complicated kind, have been confounded more or less with Convulsive Asthma of nosologists, and when iron, or peruvian bark have been exhibited, these valuable medicines have met with unmerited disgrace.

But, besides this cause for the rejection of tonics, the want of firmness in continuing the use of them, when properly indicated, is a great source of their discredit.

A febrile affection comes on during a course of steel or mineral water, and the medicine is discarded never to be resumed.

Peruvian bark loads the stomach, and brings on dyspnœa in one preparation, and it is abandoned without trying another of lighter digestion, and more divided parts.

I can affirm, that in the intervals of the paroxysms of the first, third, and fourth species of Asthma, tonics are generally beneficial, and that a temporary inconvenience from the use of one form, should incite the physician to find another, and apply it, never abandoning the general intention.

In the second species their advantage is more doubtful, and their exhibition must be decided upon, by careful attention to remote causes.

In pursuing, consistently, a course of tonic medicines in this disease, the physician must prepare his patient for the necessity of long perseverance. A predisposition is to be cured which consists radically in laxity of muscular fibre, and consequently in feeble vascular contraction. This state has been growing very probably for years, and the expectation of removing it in as many weeks or even months, is puerile and not to be defended.

It is almost as rational to promise, that a remedy shall confer upon the soft fibre of an infant muscle, the premature density and tone of adult growth.

In the first and third species of Convulsive Asthma, the practitioner may be safely referred to all medicines which belong to the class of tonics, which may be taken up and suspended, or variously combined, according to his judgment. Too long use of one form diminishes its influence, whilst another will continue the progressive impression with additional force.

In the choice of tonics, the preparations of iron are to be preferred as essential means of cure. These should be occasionally assisted by bitters and peruvian bark, and the state

of dyspepsia is never to be overlooked, but obviated by frequent interposition of absorbents and rhubarb. Opium is also required to tranquillize occasional uneasiness from the new excitement of preparations of iron. Oxygen is too well recommended upon principles closely connected with the predisposition and remote causes of Asthma, to omit its use, by modes of exhibition now generally known,

I have tried calcined zinc in seventeen paroxysms, and more intermissions, without being able to discover the smallest advantage from its operation. In general it loaded the stomach, when given in a full dose. The accounts which are received of its efficacy must be assigned partly to enthusiasm, and more generally to the want of discrimination of the species of Asthma, and the erroneous interpretation of the causes which terminate the fit. These are more or less dependent on the density of the atmosphere, and changes in its degrees of purity, and frequently on the condition of the first passages hitherto greatly neglected in treating the disease.

SECT. XVII.

A plan of treatment traced out in the Paroxysm of each species.—General rules of diet for the paroxysm and intermission.

IN a paroxysm of Convulsive Asthma, we are to consider what species of the disease it belongs to, and next the indications which are to direct us in the treatment.

Paroxysm of the First Species.—The indications are to diminish the fullness of the pulmonary vessels, by determining the blood to the surface of the body : to accelerate the passage of the blood from the right to the left side of the heart : to remove the extravasated serum already present by absorption, exhalation, and mucous expectoration : to correct dyspepsia, and encrease the tone of the first passages.

In answering the indications of every species of Asthma, we are to employ the instruments proposed in the last section, with the practical cautions there recommended.

Gentle puking will afford instruction on the extent of dyspepsia as a remote cause, and the paroxysm will go on with milder exacerbation, if irritating matter is removed from the stomach and duodenum. Afterwards a draught with distilled vinegar ℥i. and pulv. ipecac. gr. iii. may be pursued every four hours, as a means of determining to the surface of the body, and promoting absorption and exhalation. If costiveness prevails, it will be necessary to remove it, carefully avoiding purging.

Instead of acetous draughts with ipecac. the physician may see reason to prefer chalk, or magnesia usta in a draught with the same nauseating ingredient. The indication of disorder in the first passages, will determine his choice.

To accelerate the passage of the blood to the left chambers of the heart, besides these means, oxygen should be inspired, diluted according to the rules of Dr. Beddoes. In the morning no time should be lost in sup-

plying the patient with clear coffee, as soon as he awakes, which should be repeated at intervals with dry toast.

The patient should also take during the remission, a bolus of pulv. columbo, with tinct. opii a few drops, every three hours, and infusion of coffee or camomile; ~~the~~ the nauseating draught being suspended in the intervals of the exacerbations.

When the second exacerbation commences, the nauseating draught must be resumed, at first to excite puking, and to be repeated afterwards without that effect. In the second remission, the plan of the former should be restored. The third exacerbation will be probably mild, and the acetous nauseating draught may be united with æther, and a proportion of opium. With this plan there will appear on the third day, a considerable tendency to expectorate, which should be promoted by ammoniac, with vinegar of squill and tinct. opii, or with volatile salts. Ammoniac is called an expectorant, but the patient before this period, too frequently takes this nauseous medicine without use.

From this time, bitter infusions of myrrh, columbo, or quassia wood, may be given

with great advantage, more or less united with absorbent earths, magnesia, or vinegar. If the exacerbation still returns in the evenings, it may be judicious to continue the nauseating medicine at the hour of its attack, except in Asthmatics, who, having frequently sustained the paroxysm, are very liable to be impressed by habit. When this is ascertained, a considerable dose of opium, with æther and volatiles, is the specific remedy.

Paroxysm of the Second Species. The indications are to remove the subtle and acrid particles, which have been received in inspiration, or to involve them in mucus, which may guard the sensible membrane from their further irritation, and lastly, to remove the patient from the sphere of their influence.

The first intention is not readily accomplished, and whatever claims may be made to the honor of curing paroxysms of this species, nature is often the patient's only friend. The irritating offence will naturally encrease the action of the bronchial vessels, their lubricating lymph will be secreted to sheathe the passages from further injury, and this event takes place without any thanks being due to art; it may be promoted by saline

antimonial diaphoretics, and nauseating doses of ipecac. adding tinct. opii when the paroxysm declines.

A change of the wind, may likewise save the physician every trouble in executing the last intention, but if this relief does not come, it is necessary to direct a different residence.

Paroxysm of the Third Species.—The indications are to discharge irritating matter from some one of the hollow viscera below the diaphragm.

The diagnostics, it must be confessed, are often difficult to ascertain. But if the disorder does not belong to this species of Asthma, we must assign it to the first, and the same preliminary treatment with emetics, may be safely instituted. After one gentle emetic, an opinion may be formed with more precision, whether pulmonary irritation is present as well as abdominal, which may be discovered by the cough that attends in both. In the first species it is so small and painful as to be suppressed by voluntary efforts. In this it is more open, but equally without expectoration, as in the beginning of the other.

The considerations, analogies, and facts of Sect. XIV. may direct the inquirer further in the diagnostics of this species.

It may be necessary, in some cases well understood from former circumstances, to give crude quicksilver triturated into a bolus with conserve, ~~or~~ calomel with rhubarb, or hydrargyrus cum creta. But generally we are to pursue the most quiet means of opening the first passages, to discharge acrimony.

After a moderate evacuation, if the habit is inveterate of convulsive contractions, an opiate may be given with great propriety, but in young Asthmatics, if the offence is only excited in the alimentary tube, the paroxysm may be suspended, or the exacerbation be so mild as not to distress the patient. Whether this state is obtained by the operation of an opiate or not, absorbent earths are eminently useful, and should afterwards be continued through exacerbations and remissions, in a vehicle saline and bitter, and opium, with ather or not, may be added, as judgment may direct.

Paroxysm of the Fourth Species.—The indications direct us to make sensation less acute, or by diversifying impressions to dis-

fever the chain of perceptions, connecting themselves in the mind with the primary cause.

To be correct in discriminating this species, is not always possible, but that there is reason for the establishment of it, is proved by the analogy of all convulsive contractions; by paroxysms returning upon so minute causes of offence, as to be traced with difficulty, and at last only through the links of mental association of ideas.

Here we see the use of opium, and other antispasmodics; their influence on animal sensation prevents the impression of slight causes, which are not likely to endanger a function, but which would excite the reaction of muscular convulsions, without their exhibition in habits already distinguished.

It is apparent that this affection may supervene upon the exacerbations, in each of the former species. Nature or art may have removed the irritating offence, but convulsive motions may still continue, at greater or less intervals. In the first species and in the third, it may be pretty well concluded that the recurrence is owing to habit, if the patient is considerably improved in health; if dyspepsia is greatly diminished, and if expectoration and wheezing do not terminate the fits.

But no diagnostic is so strong as the effect of medicine. Under authority of circumstances, opium and æther may be judiciously ordered in large doses, and in the alteration of symptoms which has been described, these antispasmodics are instantly useful.

DIET.—The Asthmatic should avoid the *Errors of Diet* pointed out as exciting causes, Sect. X. His food should not be generally fluid or weak.* In the second species we have the necessity of providing for a diaphoresis, but the stomach requires solids, even in that. Vinous drinks should be avoided in the paroxysm of the first species in particular, and watery Gruels and broths are equally bad, taken largely. Whatever is stomachic is proper, if it does not stimulate. Acidulated water, milk and water with toasted bread or biscuit, rice boiled in broth until it is soft, without fat, are suited to the paroxysm.

Infusion of coffee may be considered medicinal, in every species of Asthma except the second, in which it is too

* It is doubtful if fluids are easily digested, though their thinnest parts are copiously absorbed. See Mr. J. Hunter, *Observat. on Digestion*, p. 218.

heating for common use. It is best in the first and third species, in which dyspepsia is so predominant, as to make the treatment of one not inapplicable to the other. Sir J. Pringle speaks of it in the paroxysm as a most powerful medicine, and directed it in the proportion of one ounce to a dish, without mixture, and repeated every half hour. Dr. Percival gives his authority for the use of coffee in Asthma, as a successful means of relief. Sir J. Floyer used it with great benefit in the latter part of his life, as appears from the account of Dr. Musgrave.

If coffee is boiled it loses part of its flavour, it should, therefore, be infused like tea, by pouring boiling water upon it in a close pot.

From the close of one exacerbation to the beginning of the next, a more cordial aliment may be used, but not so exciting as in the intermissions of the paroxysm. Coffee and ginger tea are the most cordial articles which should be allowed. Hot liquors are always improper; cold water is taken with great benefit, and if acidulated with vinegar, its good effects are often more considerable.

It is particularly necessary not to oppress the stomach by more than it can govern: but it is not less important in an advanced state of the disease, to supply the stomach with ten-

der animal food and light wine. Examples of this kind are numerous, but a specimen of the cordial diet is given with clear evidence of advantage, by Dr. Whytt.*

The practice of taking rich soups, and broths, is very injudicious in all stages of Asthma. The vessels are both filled and relaxed by such a diet, and the stomach is not improved by their use. To be more particular would be a repetition of the cautions as to *Errors of Diet*, in Sect. X.

* Observat. &c. on the Cure of Nervous Disorders, p. 502.

SECT. XVIII.

The Predisposition removed and the disease cured.
—*Examples of the practice.*—Conclusion.

WHEN the paroxysm has subsided, we are to proceed with a further application of remedies indicated by the remote causes. This part of the practice has been little attended to,* though it is only by removing the predisposition, that the disease can be cured.

It is our duty to urge the necessity of counteracting exciting causes, and to shew what condition of body it is, in which these causes are suffered to operate their effects. Unless this honest sollicitude of the physician, is answered by the firm submission of the patient, the latter cannot become impervious to the future attacks of Asthma, though a paroxysm has terminated in the most perfect intermission.

* See Tonics in Sect. XVI.

The reader has anticipated the plan of cure, if he has attended to the predisposition and exciting causes of the first species, which makes so large a majority of cases. He is referred to Sect. XI. XII. XIII. XIV. where the *nocentia* are generally explained, and counteracting means are to be deduced. The remedies of the 16th section may further assist his views, if he particularly notices oxygen, stomachics, and tonics.

In the first species it is obvious, that the proper indications are to be only answered by the use of medicines, which can give a contractile tone to the pulmonary capillaries, encrease the power of the stomach and bowels, and promote absorption and strength through the whole habit.

Peruvian bark, iron, cold bathing, exercise, change of air, oxygen, bitters, absorbents, and acids, these are the means, which, diversified according to their effects, will prevent the recurrence of paroxysms, by curing the condition of body in which they are excited.

We must continue absorbents from the close of the paroxysm, making use of magnesia when the body is costive, but preferring chalk in common instances. This medicine,

given in bitter infusions, will oppose dyspepsia as a temporary relief, but must not be relied upon for a more extensive advantage. The preparations of iron are to be given at first in small doses, and afterwards encreasing the quantity. If heat, or pain, occasionally attend, we must submit during these symptoms to suspend their use, and substitute saline draughts with opium.

Upon the *terrentia* of the paroxysm appearing, their exhibition must be again stopped, and the plan pursued which has been pointed out in the last section.

Every preparation of iron may be used in the intervals of the paroxysm, but the *rubigo ferri* is preferred. The directions which are given by Lewis and Cullen, and other writers, on the *metaria medica*, are well known, and should be generally observed in prescribing this mineral.

I have many proofs of success from a patient continuance of this plan of treatment, but a short example is enough.

A clergyman, 48 years old, had been subject since his thirtieth year to this species of Asthma. I had seen him in two paroxysms, and after the last I succeeded in engaging his attention to a course of medicine to prevent

a return. A powder of crab's claws, rhubarb, and pulv. aromat. was directed every day after dinner, and to be repeated oftener, if flatulence of the stomach came on. I also prescribed as follows: R. Ferri Vitriol. gr. x. Extracti Chamæm. ʒiss. Ol. Cinnam. Gutt. iv. Pil. xxx. He took three of these pills twice a day, with infusion of columbo root and ginger, for several weeks, when the paroxysm returned. At the close he resumed them. After a few days they were changed for rubig. ferri, twice a day, and rhubarb every night, and the cold bath was used every day; his diet was more cordial, and porter was indulged in, medicine was occasionally intermitted, and frequently changed into other forms of the same class. He likewise bathed in the sea for several weeks. He was used to sustain twelve paroxysms in the year, but he has been free from them two years, and carries every mark of health, with a perfect freedom of digestion and breathing.

In the *Second Species*, exhalation should be promoted from the vessels of the lungs, by the use of diaphoretics. Small doses of opium are usefully conjoined, and the patient should not be subjected to the influence of irritating causes, such as are known to exist in towns and manufactories.

The Dry Asthma seldom occurs under the distinctions before marked out. It is not a disease of such dangerous debility as the first, but it is more subtle and capricious in its attack, and less usefully influenced by the action of tonics, which may frequently be injurious by encreasing dryness of the pulmonary membrane, and laying it more open to offence. It may be seen in the progress of convalescence from the first species, and is then an indication of tonics having performed their part, and of the propriety of suspending them. After many repetitions, the paroxysm or exacerbation, may depend only upon the principles producing the fourth.

A gentleman had been many years subject to this species of Asthma, which usually terminated in some expectoration, and when the tracheal passages became moist the paroxysm began to subside, at length he left a populous town on account of the frequent returns, and went into country lodgings only one mile distant. He was free from his complaint, except the wind blowed from the town, which brought on a paroxysm in two hours from the change, in six instances. When the wind blowed from the country, although easterly, the paroxysm soon subsided.

He removed two miles further, and in this situation lost his complaint, taking small doses of opium and absorbents, which prevented irritation from very slight offence, and corrected his digestion which was faulty: but the grand means appeared to be a situation more remote from the origin of effluvia, which could not arrive at his lungs, but in so diluted a state as to lose their influence.

The *Third Species* is to be cured by the means proposed in the first, but with a more free use of absorbents, and a more rigid attention to diet. Chalk and Opium will astonish the Asthmatic, by the excellence of their effects, when the irritation proceeds from dyspepsia of the first passages only. Of irritation in the uterus an example was given in Sect. XIV. I have no doubt of acrimony in the stomach, and duodenum gradually accumulating until a paroxysm is frequently excited without other irritation; but more extensive observation, with reference to the principles here laid down, is necessary to arrange distinctly the diagnostics of the first and third species. I have frequently given Cretæ ppt. ʒss. Tinct. Opii Gutt. xv. Ætheris Vitriol. Gutt. xl. three times a day, to a patient who had sustained paroxysms of Convulsive Asthma pre-

ceded by puking, flatulencē, acidity, and other symptoms of a disordered stomach. This medicine delayed the returns, and a course of iron, with other tonics, was pursued with great success in confirming the habit, and curing the disease, if the absence of the paroxysm for six, four, and three times the length of former intermissions, can vindicate this conclusion. I infer, from the efficacy of this medicine, that the cause must have existed in the first passages, but if the facts to which I appeal can be explained otherwise, I relinquish my theory without regret; but not without again adverting to those principles of the animal œconomy regulating muscular contractions, which were explained in Sect. XIV.

The *Fourth Species* must be attempted upon principles suggested in Sect. XV. The application of which will not be difficult when the diagnostic is well established by the effect of antispasmodics, and the progress of certain convalescence. The influence of external impressions must be maturely considered. Tonics have frequently removed debility from the Asthmatic, and a change of perceptions, aided by the use of opium, to abate sensibility of slight irritations, would have se-

cured him from relapse if the exertion had been recommended, or its necessity foreseen. A neglect of these means may be considered in many instances as the cause of recurrence of muscular convulsions of the organs of respirations. This truth might be supported by the evidence of several cases within my knowledge, but I shall give the following as an example particularly under my observation.

R. B. enjoyed general health in various situations until 1783. When dyspepsia first attacked him at 25 years of age. The symptoms encreased gradually for four years. He was hypochondriac, sleepy after meals, and had constant pains in the intercostal muscles.

1788.—Reading was painful, his eyes constantly inflamed; a stupor came on every night, and apoplexy was apprehended. He had lived upon a very weak and fluid diet, and taken saline medicines very injudiciously.

In the summer, after awaking in the morning, he perceived some wheezing in his expirations, but no dyspnœa.

In the autumn, after a catarrh, and fatigue in riding, he was seized in the usual manner, with a paroxysm of Convulsive Asthma of the first species.

In the winter, he had several paroxysms, and pursued the means of alleviating them, pointed out in the preceding sections. His experiments frequently prolonged their duration, and the intermissions were neglected.

For four years this disease preserved its character, and was remarkably excited by the following remote cause:—The elevated flat of Solihull is the highest part of Warwickshire, from which rivulets descend to the eastern and western oceans. The soil is gravelly, but always moist with springs; the air is light, and continual evaporations make it cold. He was frequently called to this spot by the ties of family, or motives of business, from a residence forty miles distant, and two hundred feet nearer to the level of the sea. In his first visit, after he had sustained the Asthma, he was seized with a very severe paroxysm on the evening of his arrival. He was laid up during his stay, and the symptoms had not subsided when he pursued his road back. As he descended from the high country into the rich pastures of Leicestershire, the dyspnoea gradually went off, notwithstanding great fatigue. During four years he repeated this visit in warm and cold

weather, and under all circumstances, seven times, but with the same bad success in every attempt.

1792.—He had tried the effect of numerous remedies in the paroxysm, and had attained some advantage over it.* Dyspepsia was less, and his general health improved, but he had not yet succeeded in lengthening the intervals.

He now pursued, more vigorously, the plan which he had adopted. He took iron in large doses, and in all preparations, but preferred the rust, which corrected dyspepsia most powerfully. He went into the cold bath every other morning, and took absorbent earths frequently with bitter infusions, and rhubarb.

In the summer dyspepsia was greatly abated, and the intermissions became longer. In October he went to Bath, and drank the water a few weeks with great benefit. Upon his return he resumed his tonics, and trusted chiefly to the rust of iron, taking chalk more seldom. The cold bath was suspended in the winter.

* See the two preceding Sections.

1793.—Some boils had appeared in the last year, and they were now more frequent upon his face and body. The paroxysms did not come on so often, but were excited by fatigue or cold, and by professional business, which he now determined to abandon, rather than his hopes of a perfect cure.

1794.—In the winter he was very free from disordered respiration, which he attributed to excursions and change of ideas, in new pursuits. In the spring he had two severe returns, excited by dust of oats and hair powder, which revived dyspepsia and gloomy prospects. But he expectorated little, although dyspnoea subsided with the paroxysm. His disease now approached the character of the second species, and the change was considered favourable. He also applied the principles of Sect. XV. to these attacks, and secretly determined to oppose a future invasion by sedatives which he had long discarded as useless in this intention,

An opportunity occurred twenty days after, when he completely stopped the paroxysm at its commencement, by two grains of opium dissolved in vinegar with æther. He enjoyed a good night, and arose in the morning without dyspnoea or expectoration,

He was now prompted to see the event of a journey into Warwickshire, but here the paroxysm came as usual on the evening of his arrival, when his mind was occupied by the perceptions which he had before experienced in the same place, and which he had great anxiety to avoid. When he perceived the symptoms, he withdrew from company, and took a draught of cold water and vinegar with forty drops of tinct. opii. Relief soon came, but not extended to a perfect removal of the affection, which he attributed to the strength of influences operating upon habit.

The dose of opium was repeated, and he had a good night, but no sleep; in the morning dyspnoea without wheezing. Further reflection strengthened his opinion that he was now under the dominion of a secondary disease established in habit, and he determined to answer the *new indications*, at any expence of effort which circumstances might demand. He recollected the aphorism of Hippocrates on the convulsive disease of epilepsy, which had been dilated in the doctrines of many modern writers applied to custom or habit, but not with the force which has been since exhibited by the author of *Zoonomia*.

Military business was most opposite to his former habits, and most likely to turn the current of his ideas, to dissolve the chain of links by which they revived old sensations, or to obliterate their influence. Exercise near the sea, where the density of the air might co-operate with other means of cure, and the opportunity of bending his mind to the principles of a new science, were his motives for taking a company in a regiment of militia, commanded by excellent officers, who were his friends.

At the end of June he joined his regiment, encamped upon a dry common, elevated above the plain, and sloping towards the sea at a few miles distance. The Colonel of this regiment is a father to his officers, and he permitted him to occupy lodgings, with his family, in the vicinity of the camp. He at first avoided, with great care, errors in diet, which are exciting causes copiously provided at military tables. But after a few weeks he found great caution was unnecessary, an accidental excess having no bad consequence. He soon gave his whole attention to the scene before him, and attempted to fill his mind with the images which it presented. A new system of tactics being ordered for

practice of the regiments in camp, he employed himself in assiduous study of its principles and their application to active service.

During the summer, and until late in the autumn he had uninterrupted health. The vigorous spring of elastic youth again animated his frame, and was attended by satisfaction and serenity of mind, which the capricious tyranny of his disorder had denied him for the preceding ten years. He generally arose at four in the morning, and frequently marched six miles, in the dust of two brigades of infantry, to be reviewed under a burning sun, and was on foot until noon before he returned to camp. When this duty was not executed, exercise was pursued in the camp ground, become equally dusty as the road, but neither cough nor dyspnoea was excited. Dyspepsia and hypochondriacism were equally overcome: Liberties were taken with every species of diet: No exertion seemed too considerable, and fatigue was never felt. At the close of the campaign he slept constantly in camp, and torrents of rain, which filled the tents with wet, and flowed through a knights-bridge house, which he was favoured with, produced no alteration for the worse.

1795.—The regiment was cantoned in the towns of Cambridgeshire during the winter, and he had no return of Asthma.

In March he had orders to take three companies under his command, and to follow other divisions of the regiment to Hull. He was now so confirmed in health, as to determine upon finishing his military experiment, when this duty was discharged.

Yet at Huntingdon, having taken cold and drunk bad wine, he had the *terrentia* of his disease, but the progress of the symptoms was suspended by opium, and finally carried off in a bilious diarrhoea.

At the end of the month, fully satisfied with the success of an uncommon experiment, he resumed his regular profession, and to the present period, (July, 1797) has felt no symptom of his former complaint. A slight dyspnoea, came on with unusual exercise and heat last September, and went off in a bilious diarrhoea without taking the form of Asthma. But what are the proofs of a perfect cure in this disease capable of so long intermissions?

He has resided in Birmingham since August, 1795, a situation of nearly equal altitude to that where he always met with a paroxysm since he knew the disease, and only seven miles from it.

The air is much rarified by numerous fires, and a population of 80,000 inhabitants; with particles of dust perpetually floating from the manufactories. He is, however, not so imprudent as to abandon preventive means.

In the summer he uses the cold bath frequently. If flatulence disturbs his stomach, he opposes the first symptoms of growing disorder, by absorbents, and bitters, always concluding this occasional plan by steel, for several days, though the symptoms soon leave him. After a catarrh he takes the same care to recover the tone of the pulmonary vessels and stomach; and with these attentions he has no apprehension of the disease returning, although the exciting causes are so ready to act.

Much more may be said upon Disordered Respiration, but febrile affections of the lungs are to be considered, upon principles distinct from those here advanced. As to the forms of Continued Asthma, they require no new comment, unless instruction was intended for practitioners of both sexes, which I do not profess to give.

We have pursued our Inquiry on Convulsive Asthma to a CONCLUSION. If its specific causes afford the indications which are consulted in the practice, we affirm, that the practice corresponds to the indications which the causes present, and embraces the best means of alleviating the paroxysm or curing the disease.

It is, however, impossible to distinguish here, the nice contra-indications, and conversions of symptoms, which may occasionally demand clinical attention. No written rules will supply the defect, which, in this disorder, as well as others, the sagacity and observation of experience can alone remedy. The general lines which are given must be considered as signals, which may be applied to, as judgment acting upon necessity may prompt, but which we confidently affirm ought never to be deserted.

FINIS.

Practical Inquiry

ON

DISORDERED RESPIRATION.









